RADIO and ELECTRICAL Review

TELEVISION - COMMUNICATIONS - SERVICE - SOUND

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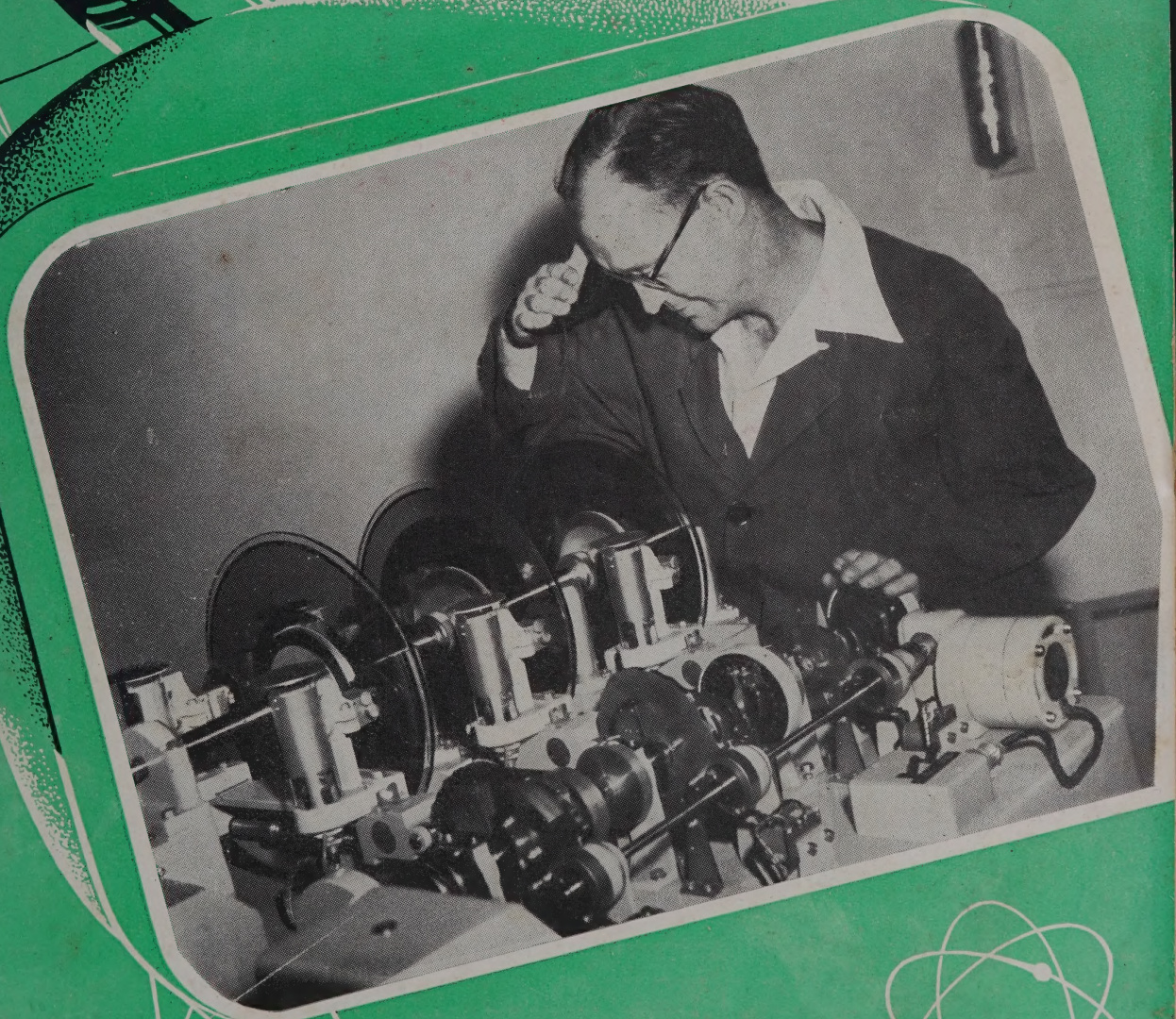

JULY, 1st 1955

VOL. 10, NO. 5

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Radio and Electrical Review

VOL. 10, No. 5 1st JULY, 1955

OUR COVER: See story page 26, "Clock That Doesn't Tick". Close up of speaker mechanism, showing three glass discs with sound tracks, clock shaft and photo-electric cells.

Official Journal of
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The N.Z. Radio and Television Manufacturers' Federation.
The N.Z. Radio and Electrical Traders' Federation.
N.Z. Radio, TV and Electrical Assn. (Inc.).

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Sole New Zealand Distributors: Gordon & Gotch (N.Z.) Ltd., Wellington

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ROLA *Ellipticals*

SPECIFICATIONS

MODEL	POWER HANDLING CAPACITY (watts)	CONE	FUNDAMENTAL DIAPHRAGM RESONANCE 5 c.p.s.	FREQUENCY RANGE c.p.s.	VOICE COIL IMPEDANCE Ohms at 400 c.p.s.	PRINCIPLE DIMENSIONS (Inches) Overall	Front to Rear	Baffle Opening
5-7H	4	F86	115	110-6,000	3.5	$7\frac{3}{8} \times 5\frac{1}{8}$	$2\frac{7}{8}$	$6\frac{3}{4} \times 4\frac{5}{8}$
5-7L	5	F86	115	110-6,000	3.5	$7\frac{3}{8} \times 5\frac{1}{8}$	$3\frac{1}{8}$	$6\frac{3}{4} \times 4\frac{5}{8}$
6-9H	4	F70	115	110-5,500	3.5	$9\frac{7}{32} \times 6\frac{11}{32}$	$3\frac{5}{16}$	$8\frac{3}{4} \times 5\frac{3}{4}$
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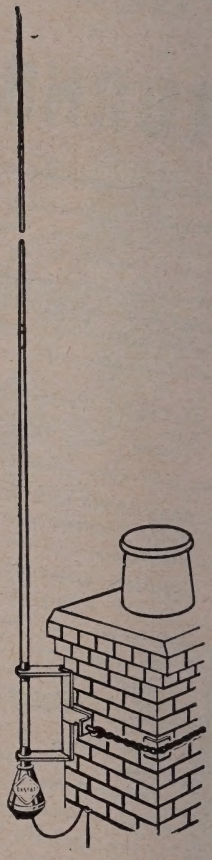

THE "EXSTAT" AERIAL

VRA 301	Wall Mount Rod	£ 4 13 4
VRA 302	Chimney Mount Rod	£ 5 8 4
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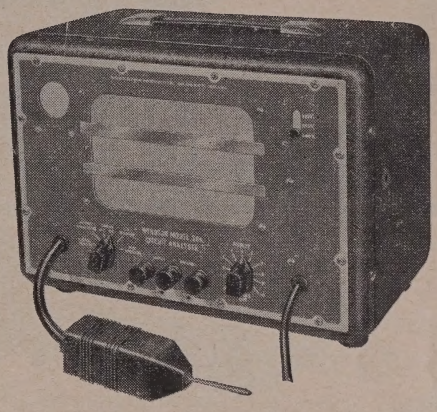
CIRCUIT ANALYSER
Model 20 B



This instrument is designed for fault-finding on Radio Receivers by tracing the R.F. and A.F. signal and checking its condition through the receiver from aerial terminal to speaker. It comprises a H.F. detector in a probe, coupled to an audio amplifier, speaker, and magic-eye indicator.

- FINISH: Case, panel, and chassis are of steel finished in crackle enamel.
- DIMENSIONS: 12 x 8½ x 6 in. (32 x 21 x 15 cm.).
- WEIGHT: 10 lb. (4.5 kgm.).

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50 pfd. 2,000 volt	42/9 each
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15 pfd. midget variable	7/9 each
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AUCKLAND WELLINGTON CHRISTCHURCH
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A.6

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A COMPLETE SET OF ENGINEERED PRECISION PARTS; EASY TO ASSEMBLE; 3 MOTORS; TAPE SPEEDS $3\frac{3}{4}$-$7\frac{1}{2}$-15 in. PER SEC. FAST FORWARD AND RE-WIND; PRE-SET RECORD AND PLAY-BACK LOCK. "WEARITE" FR7 RECORD AND PLAY-BACK HEAD. "WEARITE" FE7 ERASE HEAD

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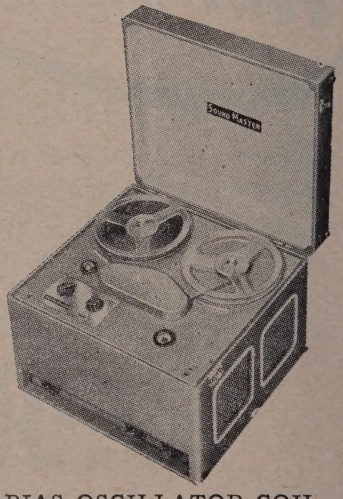

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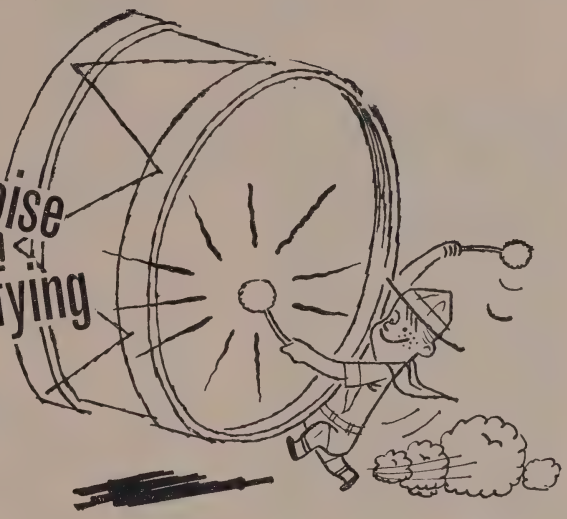
low noise
voltage amplifying
pentode



Z729

The home construction of high quality sound equipment is booming! Make sure of getting your share of this business by stocking a comprehensive range of Osram Audio Valves. The Z729 shown here is specially designed for use in the early stages of high gain amplifiers. It combines high gain, negligible microphony with the phenomenally low input hum voltage of 1.5μA.

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The Z729 data sheet appeared in the May, 1955 issue of "Radio and Electrical Review".

Osram

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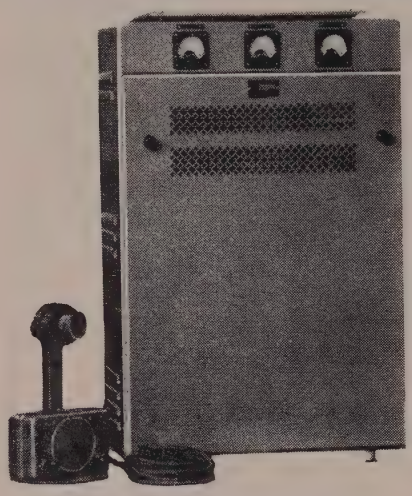

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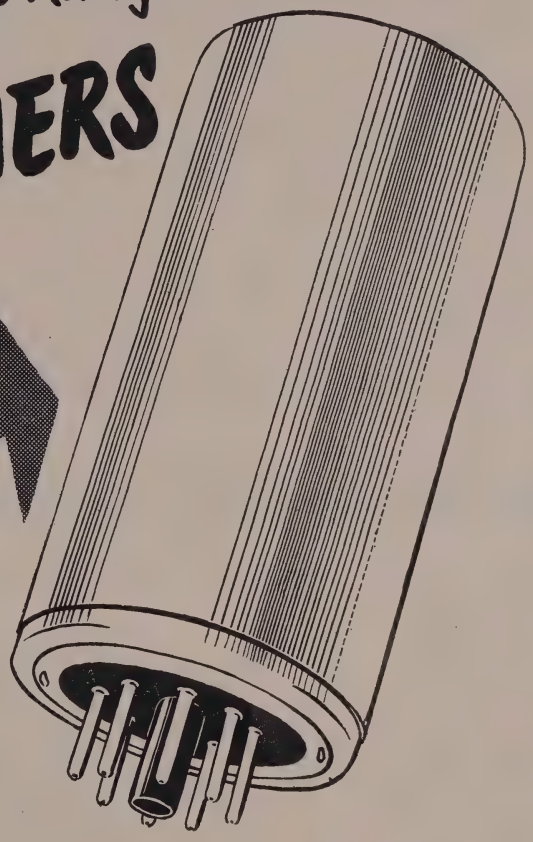
NEW ZEALAND RAILWAYS

Miniature Wide Range PLUG-IN TRANSFORMERS



The transformers are astatically wound on mu-metal cores and are enclosed in a mu-metal shield. The whole is screened by a drawn can of magnetic alloy. A standard octal plug-in base is provided. The windings are made with tough, synthetic-enamel insulated wire. A pure, inert, micro-crystalline wax with high electrical and moisture proofing is used as the can-filling compound. Both primary and secondary windings are centre-tapped. Special input or shunt fed, low-level, output transformers can be wound to order.

Physical and Electrical Data

Height from bottom of spigot to top of can	3 in.
Diameter	1 9/16 in.
Height above Chassis	2½ in.
Weight	½ lb.
Frequency Response from 30 c/s. to 15 K/cs.	

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Manufacturers of all kinds of Transformers and Fluorescent Lamp Ballasts

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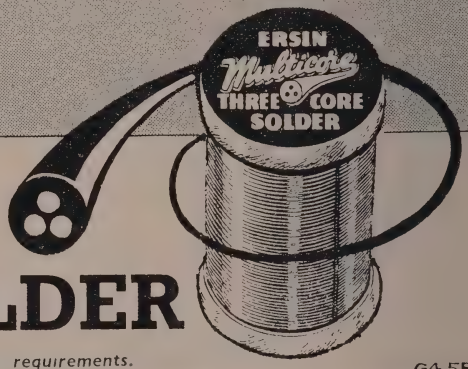

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Available ex-stock in a range of gauges and alloys to meet all requirements.

G4.55

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Also available from all branches of Turnbull & Jones Ltd.

NOW 40-14,000 C.P.S.

This is the first time that a studio—standard tape recorder, with every up-to-date feature has been presented as a portable model!

The "Grundig T.K. 819" has the same controls as its famous predecessor (the T.K. 9)—two-speed operation, extra recording time, and 4-5 watts output of a quality that simply must be heard to be believed.

Trade inquiries to: **DIRECT IMPORTS (N.Z.) LTD.**
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the New

GRUNDIG "TK 819"

HERE ARE SOME OF THE SPECIFICATIONS!

Simple push button control: approx. output 4-5 watts undistorted! two-tape speeds of 3⅜ ins./sec. and 7½ ins./sec; recording time of 2 x 60 mins. at 3¾ ins./sec; Automatic stop at end of spool; Fast forward and fast rewind time approx. 2 mins. per full tape; Recording level meter by magic eye.

DIMENSIONS: 17 in. x 16½ in. x 9¼ in. Weight: 46 lb.

Compensated tone control for treble and base emphasis.

Cabinet in two-colour finish with two tape desk.

Recording sense: Top left to right (British and U.S. standard).

CALVERTS have the cabinet you need

STEEL CABINETS

These cabinets have round or square corners as required, and a hinged, recessed door on top. Adequate ventilation is assured by louvres on the sides and a two-inch opening extending the entire width of the back. The cabinets are finished in black or grey wrinkle enamel Hammerlux. Prices listed do not include chassis or panel.

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16 x 9	15 x 9 x 3	£3 15 0
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19 x 20	18 x 11 x 3	£11 5 0
19 x 30	18 x 11 x 3	£12 10 0

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6	7	12	20/-
7	9	15	22/6

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4	2	2¾	6/-
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7	5	3	11/-
12	7	4	12/6

Punching can be done at a small extra cost. Postage and freight paid on orders over £2.

CALVERTS LIMITED

138 TUAM STREET, CHRISTCHURCH

Lighten up that Soldering Job!

Get right on the Beam!

with "SUPERTONE"

Electric Eye SOLDERING GUN

Light, compact, easy to handle, Supertone has these features:

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The Supertone Soldering Gun is built for A.C. 110/230v. input at 5 or 60 cycles with a consumption of 60w. Its net weight is only 1¾ lb and it is ready hot for use in 5-6 seconds.

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"SUPERTONE" ELECTRIC EYE SOLDERING GUN

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This was fully described in the May, 1955, issue of "Radio and Electrical Review." **Price £10 15s., including plug-in coils.**

★ **An Audio Frequency Output Meter**
Fully described in the April, 1955, issue and illustrated on the front cover of the May, 1955, issue. **Price £8 10s., as illustrated.**

★ **An Oscillator for the Audio Experimenter**
Fully described in the February and March, 1955, issues. **Price £20, as illustrated, with fully calibrated dial.**

★ **Five-valve Portable Receiver Chassis.** Fully described in the October, 1954, issue. **Price £11 10s. as illustrated on front cover of above, less batteries, but including DM70 magic-eye.**

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20,000 ohms per volt

MODEL 8 UNIVERSAL

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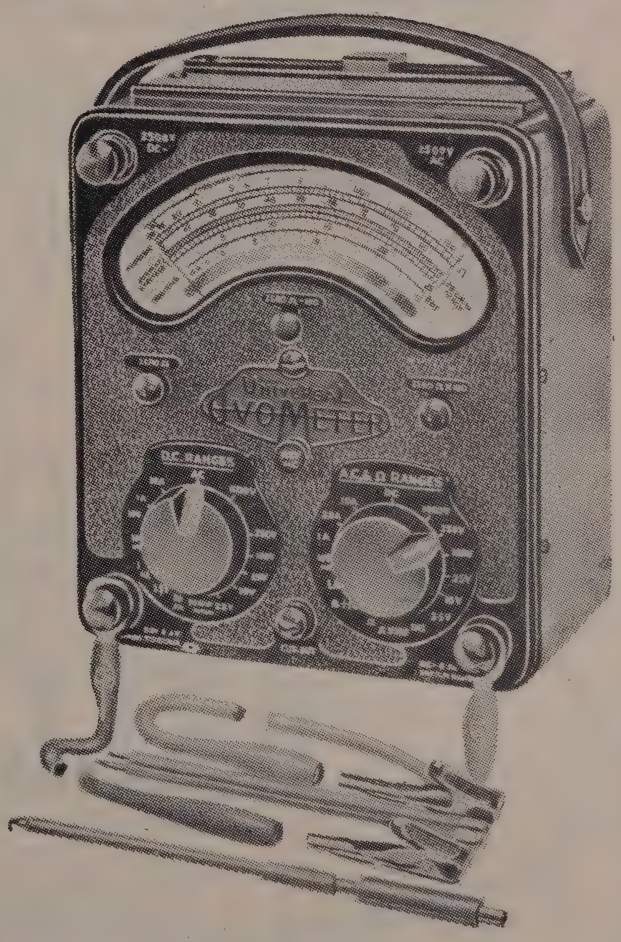
AVO REGD. TRADE MARK

This is a high-sensitivity version of the world-famous Universal AvoMeter, having a sensitivity of 20,000 ohms per volt on all D.C. ranges and 1,000 ohms per volt on A.C. ranges from 100 volts upwards. A decibel scale is provided for audio-frequency tests, also a press button for reversing the movement to obviate the inconvenience of changing over the leads when encountering opposite potentials about a common reference point.

The instrument is compact and portable, and is protected by an automatic cut-out against damage through inadvertent overload.

D.C. VOLTAGE	D.C. CURRENT	A.C. VOLTAGE
2,500 V	10 A	2,500 V
1,000 V	1 A	1,000 V
250 V	100 mA	250 V
100 V	10 mA	100 V
25 V	1 mA	25 V
10 V	250 mA	10 V
2.5 V	50 mA	2.5 V

A.C. CURRENT	RESISTANCE
10 A	0—200 Megohms
2.5 A	0—20 Megohms
1 A	0—2000 Ohms
100 mA	



Size: 8½ x 7¼ x 4½ in. Weight: 6½lb. (approx.)

Write for full information to:

THE NATIONAL ELECTRICAL AND ENGINEERING COMPANY LIMITED

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featuring
WIDE RANGE
record reproduction

A new listening experience awaits you with this superb set. 6 valves — 12" heavy duty speaker — automatic record changer — solid oak cabinet.

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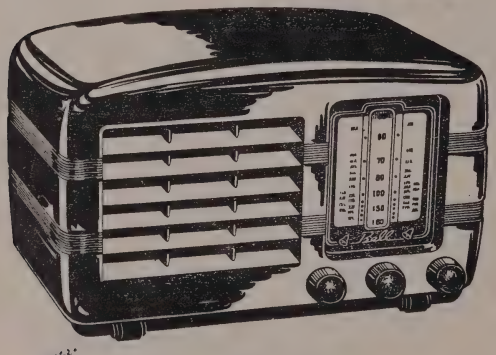

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gives Australian reception with built-in aerial

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All the latest features including variable tone control and floodlit dial. Choose from 4 shades of attractive plastic cabinets.

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Ronette G-210 Streamlined microphone

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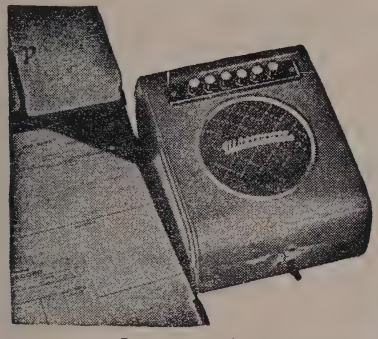

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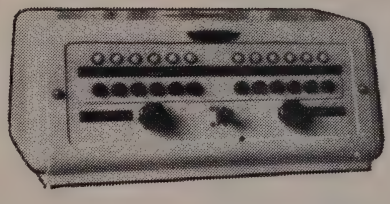

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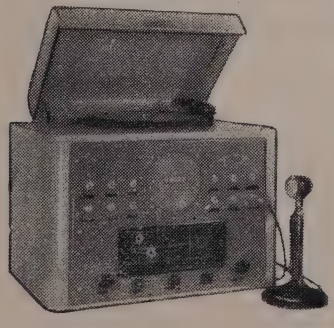

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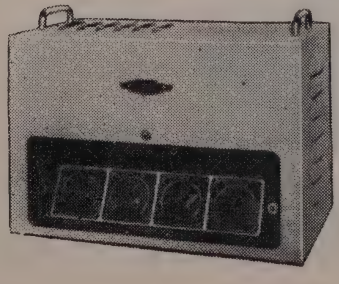

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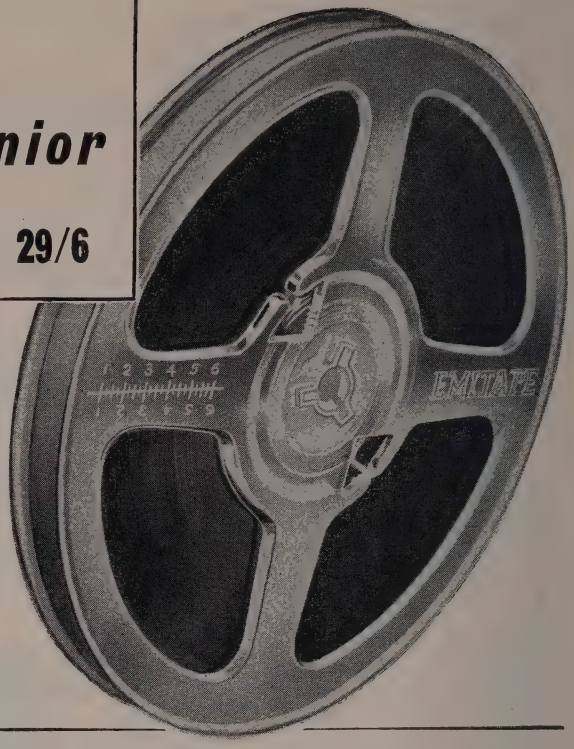

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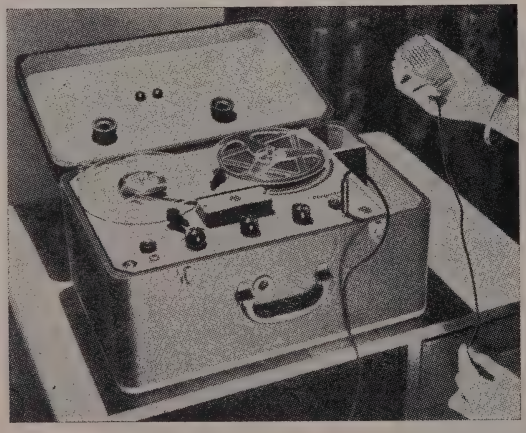

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More High-Quality Reproduction

In last month's editorial we mentioned briefly some of the effects which were noticeable while attempting to produce high-quality sound in a hall, as distinct from in an ordinary living room. Since preparing the lectures and their associated demonstrations, we have been encouraged to investigate some of the conclusions that a few weeks' concentrated activity brought to light. Some of these were mentioned during the lectures, but others of them were not, since they raise what are predominantly technical points, but all of them are of great interest to those who are active in this fascinating field.

We have for a long time felt that altogether too much pother is made in technical and non-technical circles about the question of compensation for recording characteristics. By this we do not mean that there is no necessity for it. We do mean, however, that a multitude of different playback characteristics is quite unjustifiable. Not only does their provision make the record playing equipment more complicated and therefore more expensive than necessary, but they are in themselves quite useless, provided that suitable variable controls are available to the user. As expected, this statement caused considerable discussion when made in public, and not a little disagreement. We do not propose to go into the question in detail on this page, because we have something better in store—namely an article in which the contentious point is proved quite conclusively—but it should be mentioned here that the idea has a sound technical basis of fact, and is not therefore merely a bee in our editorial bonnet.

Another most interesting finding is that even among high-priced commercial amplifiers, several of which are readily available in this country, differences in sound CAN be detected. One might expect, for instance, that in view of the very low distortion figures claimed by the manufacturers, no detectable difference would be found, and it was with some surprise that exactly the reverse was noted. It seemed that the usual tests with sine-waves would be very unlikely to unearth any great differences between those amplifiers which sounded well and those that did not, so it was decided to give them somewhat more drastic treatment. by way of square-wave tests. These have just been completed in our laboratory, and the results have been quite illuminating. They have turned out to be so instructive that we propose to present them to readers in the form of a special article, illustrated with photographs of the actual waveforms obtained in the various tests. It seems that to some degree at least, listening tests have been confirmed by square-wave testing, and since the former were conducted first, the comparison can claim to be an objective one. At present we await with much interest the promised results of square-wave tests on some well-known commercial amplifiers, which have been undertaken by Mr. F. Langford-Smith, and are about to be published in our contemporary "Radiotronics".

A further point that will hearten many of those who have hankered after one of the more modern types of speaker baffle, with horn-loading, and expensive and complex construction, is that for all-round results, the old stand-by, the reflex or vented baffle is still hard to beat. This is provided, of course, that the baffle and speaker unit are propertly matched. In this connection it should be noted that this does not mean that the baffle should necessarily be built to resonate at the same frequency as the main cone resonance of the loud-speaker. Indeed, under some circumstances, the two are best placed at quite different frequencies.

This is illustrated particularly well by the very fine American speaker which we were forunate enough to borrow for our demonstrations. This speaker was in a reflex baffle built for it by the makers of the speaker unit itself. The latter had a main cone resonance at 30c/sec., but the baffle was tuned to a frequency of 50c/sec. This, according to the maker's response curve gives a quite sharp cut-off of sound output at a little below 50c/sec. The result, however, is a remarkably smooth response in the extreme bass —smoother than that of any system we had previously heard. So impressed were we with this aspect of the speaker's performance that we decided to perform an experiment ourselves. We had a reflex baffle known to tune to 55c/sec., and we procured a speaker unit with a bass resonance at 40c/sec., and put the two together. The result was an extremely smooth bass response, comparable in every way to that obtained from the original speaker/baffle combination. Of course there will be those who maintain that they MUST have response below 50c/sec., and who will therefore say that such a system is "no good." While admitting that response down to 30c/sec. is highly desirable on occasions, we maintain that there is a strong case for this way of using a reflex baffle, if one can forego the range 30 to 50c/sec., and one has a speaker unit that will reproduce it anyway. The main point is that smoothness in the extreme lower register is more desirable than extended response, unless this too can be obtained with the same degree of smoothness.

In any event, given the right unit, we are quite convinced that the conventional reflex baffle, properly handled, can produce as pleasant results as any other, with the added advantage that the said results are predictable—which is more than one can say for many of the "fancy" schemes one sees propounded in today's semi-technical literature. There is certainly no justification for stigmatizing the reflex baffle as a "boom-box". It can be made to produce noises like this, but only if mis-applied or badly designed.

Test Equipment

A DIRECT-READING IMPEDANCE COMPARATOR

Conventional bridges represent the best means for making accurate measurements of resistance, inductance, and capacity, but the bridge is too slow for many purposes. A comparator like the one described in the article below is ideal for such uses as production sorting and testing, as it is direct-reading between any desired limits of tolerance and enables up to 120 *measurements an hour to be made with ease.*

INTRODUCTION

The rather high-sounding title to this article disguises what is really a simple piece of equipment, both in principle and construction, and which can be made to do a wide variety of jobs. It can be made, for instance, to measure resistance, capacity, or inductance, or to measure the impedance of any series or parallel combination of the three. Not the least of its advantages is that it is exceedingly quick to use, and does not require a careful balancing adjustment to be made, as with a bridge. Moreover, bridges will not ordinarily indicate the impedance of things(such as electrolytic condensers) which are not pure reactances, or of practical inductors, which also are by no means pure reactances. The impedance comparator, on the other hand, will do so. At the same time it will not, as a bridge does, give separate indications of the reactive and resistive components of a complex impedance. For many purposes, such a separate evaluation is not necessary, either because the component concerned can for all intents and purposes be regarded as a pure reactance, or because any deviation from pure reactance, or pure resistance, will not materially affect the usefulness of the component in question. It is in such cases that the impedance bridge (for that is what it really is) comes into its own.

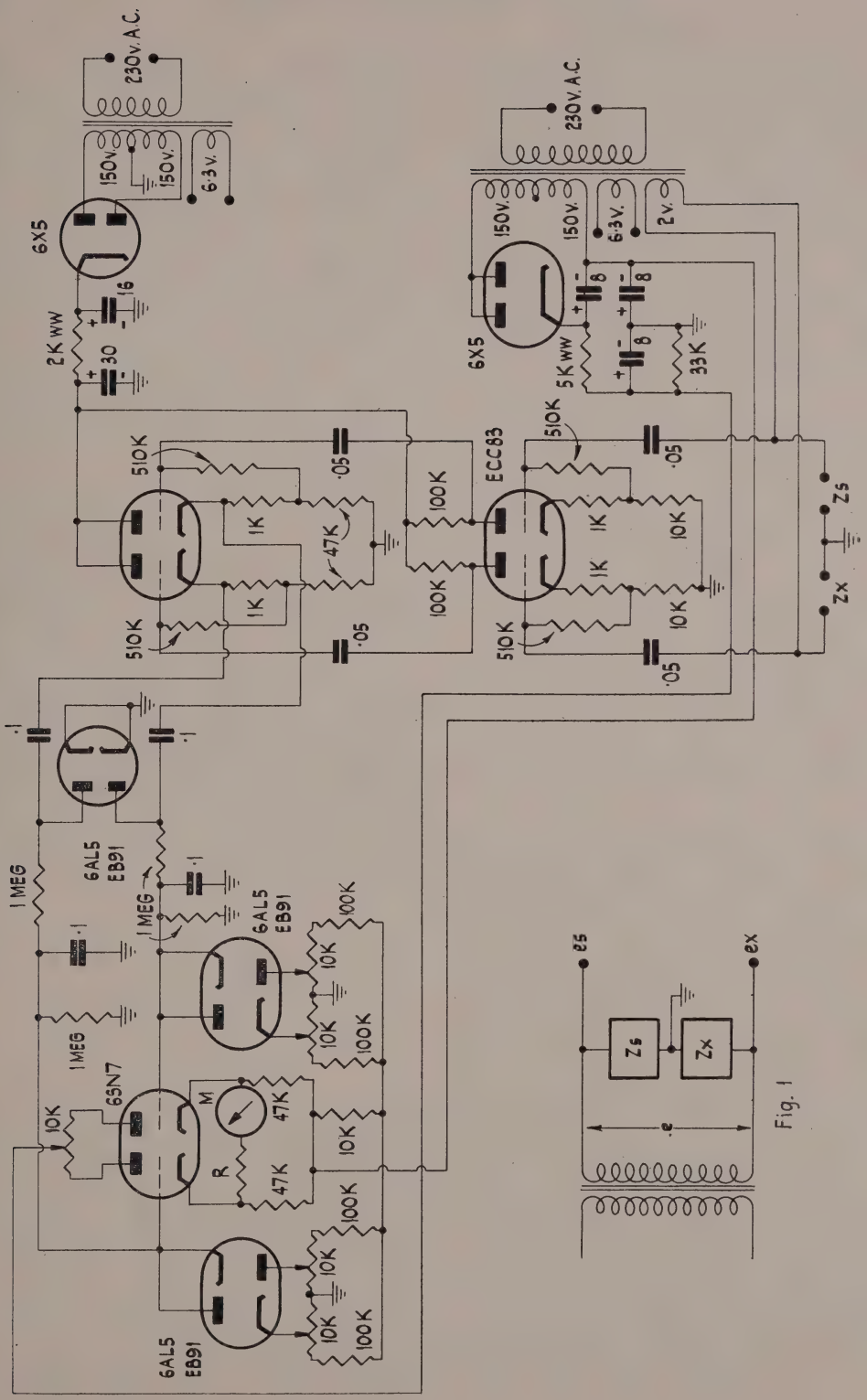
Suppose, for example, that a factory is making tuning coils for a receiver. It is important that no defective coils should get as far as the receiver assembly line, for once such a coil is installed in a set the cost of replacing it is very great; the fault has to be diagnosed by a skilled technician, who could be employed much more profitably on other work, after which there is the time-consuming job of partly demolishing a section of the set in order to remove the offending coil before a new one can be fitted. It is much cheaper in the long run to prevent the faulty component from being put into the set at all. This means, however, that every coil used by the assembly line must be individually tested. If conventional equipment were used for this purpose, a skilled technician would be needed to operate it, and to interpret its results, and at the same time the procedure would be so slow that it would be more uneconomic than not testing the coils at all. This is where reliable quick-indicating equipment can be such a boon, especially if it can be operated by an unskilled operator.

The sort of test we are considering is that in which the part is held briefly in a jig, connected to the measuring apparatus, which then indicates on a meter whether or not the property being measured falls within the allowable tolerance range or not. It is thus accepted or rejected merely on the reading given on a large easily-read meter scale. Provided that the apparatus is set up initially by a technician or engineer who knows what is being measured, and how

the apparatus works, any number of components can be tested with certainty by unskilled personnel, at a rate limited only by their manual dexterity.

PRINCIPLE OF THE MEASUREMENT

In Fig. 1 is shown the fundamental measuring circuit used in the comparator. A small voltage at any convenient frequency is fed from a winding on a transformer to a series combination of two impedances. One of these is known in value, while the other is the "unknown" which is to be compared with it. In the simplest case, these impedances are pure resistances, and for the moment it is easier to think of them as such. In the diagram, the known or standard impedance has been labelled R_s, and the unknown R_x. The junction between the two is earthed, so that it is possible to measure the voltage developed across each resistance. If the two are equal, the voltage dropped across each will equal that dropped across the other. If they are unequal, it is a very simple matter to calculate how much voltage will appear across each. For example, suppose that the unknown is 10 per cent. higher in value than the other. In this case, the "unknown" will have 110 units of resistance for every 100 possessed by the standard. Therefore, across the standard there will be a voltage of $(E \times 100/210)$, while across the standard there will be a voltage of $(E \times 110/210)$, where E is the voltage provided by the transformer winding. Thus, we could make use of the principle of the comparator by measuring one of these voltages, and then working backwards through a similar sum to the above, in order to find the resistance of the "unknown." Alternatively, we could use a voltmeter, arranged to measure either of the voltages, specially calibrated in terms of percentage. Basically, this is just what the instrument does, but the measurement is made in a rather more complicated way than one might at first expect to find.


230v. A.C.
150v.
150v.
6·3 v.
6X5
2K WW
30
16
230v. A.C.
150v.
150v.
6·3 v.
2v.
6X5
5K WW
33K
8
8
8
510K
1K
47K
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ECC83
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100K
1 MEG
6SN7
10K
M
47K
R
47K
10K
100K
10K
10K
100K
6AL5
EB91
Zs
Zx
e
Fig. 1

THE ACTUAL INSTRUMENT

The first thing to note about the actual instrument is that we do not just measure one of the voltages. Both of these are rectified, and are then applied to the halves of a balanced vacuum-tube voltmeter circuit, which is arranged to read the difference between the two voltages instead of the value of either of them. As it is not possible in one word to say why this is done in place of taking the apparently simpler course, we will proceed to explain.

First of all, the voltage applied to the resistors by the transformer winding is quite low. In the case of the instrument illustrated, it was two volts. This was decided upon because the instrument's job was to do with electrolytic condensers, which had to be tested without any D.C. polarizing voltage applied. In addition, it is always advisable to use as low a voltage as possible, especially where low resistances or impedances are to be measured, if only to limit the current through them to a small value. Now, the use of a low voltage makes the measurement of the voltages difficult. For measuring only across low impedances, it would be possible to use a 1,000-ohm-per-volt A.C. voltmeter, but this would definitely prevent the set-up from being used for measuring even moderately high impedances. Thus, if the instrument is to be at all versatile, and accurate for fairly high impedances, one of the requirements is that the voltmeter must cause very little loading of the test impedances. This looks like, and, indeed, is, an excellent case for using a vacuum-tube voltmeter.

From the simple arithmetic we produced earlier, it is clear that if the input voltage is fixed, then we do not gain any more information by measuring the voltage across both the test impedances than we do by measuring only one of them. Therefore, in order to justify, from an engineering viewpoint, the additional equipment needed to measure both of them, we will have to produce some good reasons why the more complicated way is better. Luckily, this is not difficult.

V.T. voltmeters used to have a very poor reputation with regard to instability which was unfortunately often justified. Even highly priced instruments suffered from excessive drifts, both in the setting of the scale's zero, and in actual readings. Luckily, today ways have been found to overcome the greater part of these defects, even without recourse to stabilizing the supply voltages of the valves, although this still has to be done in the most exacting applications. The chief method is to use balanced circuits, in which unstabilizing effects occurring in one valve are counterbalanced by exactly similar effects occurring in another. Thus, effects due to changing supply voltages, and even to changing valve characteristics with age, are largely self-compensating. Another method of stabilizing a V.T. voltmeter circuit is to use negative feedback, which again reduces drifts due to changing valve characteristics very considerably.

A very common, and excellently stable arrangement is shown in skeleton form in Fig. 2. Here, the D.C. voltage to be measured is applied to the grid of V_1, which is connected as a cathode-follower. Because of this, the change in potential of the cathode is almost the same as that applied to the grid, and because of the very good linearity of the cathode-follower circuit, is strictly proportional to it. In order for the meter to read zero when no voltage is applied to the measuring grid, the other meter terminal must be connected to a point which is at the same potential as the cathode of V_1. This could be done very simply by making a voltage divider of two resistors, whose values are so chosen as to bring their junction to the correct potential when the voltage divider is fed from the H.T. line for V_1. This would give some measure of compensation for undesired changes in H.T. voltage, as may be caused by altering line voltage, because, as the H.T. voltage varied, so would the potential at the junction of the resistors, and the potential at the cathode of V_1. A better scheme, as illustrated in Fig. 2, is to make the balancing voltage divider from a valve of the same type as V_1, with an identical cathode resistor to that of V_1. The grid of V_2 is earthed, and no external voltage is applied to it. Thus, V_2 plays no part in the action of the voltmeter other than to ensure that the metter has no current flowing in it when no voltage is applied to the grid of V_1, and to do so in such a way as to give automatic compensation for variations in H.T. and filament voltage. This it does because whatever changes occur affect both sides of the balanced circuit equally, and thus have no effect on the meter reading. The balancing effect is much better than if V_2 is replaced by the simple voltage divider.

This arrangement is sometimes known as a "difference amplifier." The reason is not far to seek. Supposing we lift the grid of V_2 from earth and apply a voltage to it, and a different one to the grid of V_1. For the sake of illustration, let us say that we apply a two-volt signal to V_1 and a one-volt one to V_2. Because of the cathode-follower action of the valves, the potential of V_1's cathode will change by two volts, while that of V_2 will change by one volt. The meter, however, is so connected that it reads the difference in potential between the two cathodes. Thus, if both signals were of the same polarity, the cathodes would differ in potential by one volt, and this would be the meter reading. If, on the other hand, the polarity of the signals had been opposite, the cathodes would have differed in potential by three volts, and, once more, this would be the meter reading. The circuit therefore performs electrically for us the algebraic operation of finding the difference between the two signal voltages. The sums it can find the answers to are illustrated thus:

$$-2-(-1)=-2 \qquad -2+1 \qquad 1=-1$$

$$2-1=1$$

and $$-2-1=-3$$

$$2-(-1)=3$$

In these equations, the first figure represents in value and polarity the voltage applied to V_1, while the second represents the same properties of the voltage applied to V_2.

It is this ability to respond only to the difference between the signals of each valve that gives the circuit its stabilizing effect, for if any changes in the voltages or the valves themselves should take place, they will become visible as meter readings only to the extent that they are not identical. Where the signal is applied to only one grid, the circuit of the other valve can be thought of as subtracting zero from it, while to undesired changes in the circuit conditions, both valves are effective.

Unfortunately, our comparator uses not D.C. but A.C., so that the voltmeter circuit just described will have to be preceded by a rectifier, to convert the signal voltage into a D.C. one that the V.T. voltmeter can measure. A simple shunt diode circuit like that of Fig. 3 is all that is required, and it can be connected directly to the grid of V_1 in the meter circuit. The condenser serves to filter the 50-cycle ripple from the output of the rectifier, but in the process delivers only half the total rectified voltage to the grid of V_1. Unfortunately, it also unbalances our nicely balanced circuit, because a diode rectifier applies a small output potential to the grid of the valve whether or not there is any input voltage. This is due to the so-called contact potential, which arises because there is a small current flowing in a diode even with no applied voltage. Unfortunately, too, this contact potential changes markedly with heater voltage, and is a fruitful source of drift in the voltmeter reading. It can be compensated, however, by connecting an identical diode circuit in the grid of V_2. The second diode also produces contact potential, but this, too, will vary if the heater voltage changes, and since its effects are applied to V_2, only the very slight differences between the behaviour of the two diodes will be effective in causing unbalance.

It can now be seen that, in order to provide the necessary stability in the measuring circuit, we have had to duplicate the measuring part of the circuit, even if no active part is being taken by V_2 and its diode.

SENSITIVITY

At this juncture, one might well ask what kind of sensitivity is needed for an instrument of this kind. The answer will obviously depend on the use to which it is to be put, for if a large indication is needed when the unknown differs from the standard by only 1 per cent., the sensitivity of the measuring circuit will clearly need to be a good deal more sensitive than when the meter is required to indicate from, say, — 20 per cent. to 100 per cent. The latter, by the way, is a practical case, because large electrolytic condensers are frequently made to such tolerances. Let us take as an example a case where resistors have to be sorted into two types—those which come within a tolerance of plus and minus 10 per cent. of the nominal value. The standard is made equal to the nominal value, and the meter is required to have the tolerance limits marked on it in such a way as to make use of practically the whole scale. The question is, what voltage must the meter respond to at the limit marks?

The example worked out earlier told us that the voltage across the standard resistor will be 100/210 of the voltage applied to the bridge circuit, when the value of the unknown is 10 per cent. higher than that of the standard. When the two are equal, exactly half the exciting voltage appears across the standard, so that the change of voltage across the standard resistor representing the upper limit of + 10 per cent. is ($\frac{1}{2}$ — 100/210) times the exciting voltage, which we have taken as 2 volts. This comes out to 1/21 volt. By a similar process of reasoning, it is found that for an "unknown" which is 10 per cent. below the nominal value, the change in voltage across the standard is 1/19 volt. Thus, the whole indicating range of the meter must in this case be taken up by 40/399 volt, or almost 0.1 volt. Now this represents quite a high degree of sensitivity in the measuring circuit, as most V.T. voltmeters have a lower range reading of 0–2 volts, or something like it.

There is another difficulty, too. The voltage across the standard resistor when the two resistors are equal is 1 volt. Thus, unless some method can be found for balancing this out, we will have to observe a maximum change of a tenth of a volt out of a total reading of 1.1 volts or 0.9 volts. Obviously, a better way of measuring the difference between the nominal voltage across the standard and the actual voltage when a component is being measured is to measure the **difference** between the voltages across the standard and the unknown. Then, there will be no meter reading at all when they are equal, and making a measurement will not entail reading the small difference between the two relatively large voltages. The circuit can be made to do this for us, with only the difference appearing on the meter.

This is clearly a case for using a difference amplifier such as we have described above. The voltage across the unknown is applied to one grid of the V.T.V.M. circuit, while that across the standard is applied to the other. If there is no difference, the meter will not read, but if there is, the reading will be almost proportional to the deviation of the unknown from the nominal value. In order that deviations in either direction may be indicated, the meter used should preferably be one in which the pointer is at the centre of the scale for zero current through it—what is normally called a centre-zero meter. However, as these are rather difficult to come by, a more practical alternative is to use a conventional meter and to unbalance the halves of the circuit so that with no applied voltages, or with equal ones, the pointer reads at half-scale. All that is then needed is to re-scale the meter with a zero at the mid-scale position, and the required tolerance values marked in.

For our imaginary case of plus and minus 10 per cent., it is necessary to calculate the expected reading once more, since we are now reading a different voltage. Without doing this in detail, we can see that the voltage across the standard resistor will be approximately 5 per cent. higher than half the test voltage, while that across the unknown will be almost 5 per cent. lower. Thus, the total difference is almost 10 per cent. of half the test voltage, or 5 per cent. of the total test voltage. With a test voltage of 2, this amounts to 0.1 volt, which is the same figure as is obtained for the change in voltage across the standard. Thus, there is no advantage from the sensitivity point of view (other than what amounts to cancelling out a large standing reading) in using a balanced indicating circuit. There is, however, a considerable advantage in stability, because sensitivity of the order indicated obviously requires an amplifier. If the difference amplifier is used, then we must have two amplifiers—one for each side of the balanced circuit. Now, the amplifier is a further source of drift, because of the possibility of change of its gain with line voltage and with ageing of the valves. But if the difference amplifier idea is used, then the balancing effect applies to the amplifiers as well, because then only differences in the gain of the amplifiers will have a very large effect on the readings, and small changes in absolute gain will not have very much effect on the accuracy of the instrument, since, by proper design, they can be kept to small proportions.

(Continued on page 50.)

Circuits for the Experimenter

A NOVEL A.V.C. SYSTEM

Few portions of a radio receiver seem more standardized these days than the A.V.C. system. In almost all kinds of receiver, a diode rectifier is used, which may or may not at the same time be the signal detector, and whose D.C. output is applied as control-grid bias to two or more valves in the receiver's radio frequency portion. For most purposes, this scheme works admirably, and leaves little to be desired. For others, however, it leaves something to be desired. Take, for example, the case of a receiver designed for V.H.F. Here, effective A.V.C. is often of more importance even than at lower frequencies, but it is often more difficult to apply. The reason for this is that in the interests of weak-signal performance, certain valves in the receiver are not of the variable-mu type. The R.F. amplifier stage, for instance, needs to have as high a stage gain as possible, and must employ a valve with as high a mutual conductance as possible, both requirements being brought about by the need for the best possible signal-to-noise ratio. In general, both requirements prevent the use of a variable-mu valve, so that in the ordinary way, it is not possible to control the R.F. stage with A.V.C.

Next, we find it inadvisable to use a conventional triode-hexode as the oscillator-mixer stage in a V.H.F. receiver, and instead make use of a pentode mixer, or even a triode. Neither type can readily be controlled by A.V.C. Coming to the I.F. stages, we find that in special cases it is not always desirable to use a variable-mu valve as the first stage, so that unless the receiver has a good many I.F. stages, really effective A.V.C. is going to be very difficult to attain.

Another type of receiver in which A.V.C. is difficult to use with any degree of effectiveness is the T.R.F. This time, the difficulty is usually due to the low over-all gain of the receiver, in conjunction with somewhat limited range of control given by ordinary variable-mu valves. Both types of receiver would be considerably improved if some alternative method of obtaining A.V.C. were available, and a scheme put forward in 1951 by Amos and Johnstone looks well worth the experimenter's consideration.

ESSENTIALS OF THE NEW IDEA

First, and most important, the idea put forward by these two engineers is applicable especially to high-slope R.F. Pentodes. This means that by using the new method, many receivers which by virtue of their design cannot be fitted with conventional A.V.C. without changing their valve types and possibly spoiling other aspects of their performance, can be modified quite easily so that they retain the advantages of using high-slope R.F. pentodes, while acquiring those of A.V.C. as well.

The method is to apply A.V.C. to the supressor-grids of high-slope pentodes instead of to their control grids. The action which takes place in the valve when suppressor bias is applied is illustrated in Fig. 1, which shows the way the plate current, screen current, and cathode current vary with changes in suppressor bias. It can be seen that the cathode current, which is the sum of the plate and screen

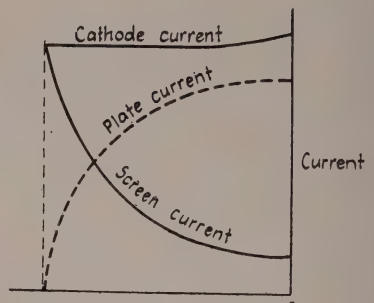


Fig. 1

currents, remains almost constant. The plate current, on the other hand is decreased, and finally cut off altogether if the negative suppressor bias is made great enough. At the same time, the screen current increases, making up for the change in plate current, and keeping the total nearly constant. In other words, the application of bias to the suppressor changes only the distribution of current between the plate and the screen. In a variable-mu valve, both plate and screen currents are reduced. Another difference between the two arrangements is that while with the ordinary system, the mutual conductance of each controlled valve cannot be reduced to zero by any ordinary A.V.C. voltage, with suppressor bias it can, so that for strong signals, the control should be very much more effective. Also, the signal distortion which takes place in a variable-mu valve when the plate current is very small cannot take place, because the shape of the control grid's transfer characteristic is unchanged. That is to say, if the signal was able to be handled by the valve when at full gain, the grid circuit can still handle it when the gain is reduced by suppressor bias, and there will not be any more distortion than before.

The main disadvatage of the scheme is that for full control by means of suppressor bias, rather more control voltage is needed than with the conventional method of control using the variable-mu valves. For instance, an EF50 requires about —50 volts on the suppressor to cut off the plate current. However, this can be overcome by the use of D.C. amplification, and the authors mentioned earlier have devised a particularly ingenious way of obtaining it, without the need for a power supply that is negative with respect to chassis. The essentials of this method are shown in Fig. 2. Here it can be seen that a large cathode resistor is used for the controlled valve—large enough to place the cathode at about 100 volts positive. The suppressor is connected directly to the plate of the D.C. amplifier valve, which is provided with a high value of resistance for a load resistor. The output of the A.V.C. rectifier is applied to the grid of the D.C. amplifier, in such polarity that increasing carrier voltage makes the grid more positive. Thus, the plate current of the D.C. amplifier increases, taking the plate in a negative direction, and with it the suppressor of the controlled valve. Since it is possible

for the plate of the control tube to go as low as 20 volts positive, such an arrangement would enable the suppressor bias to reach a maximum of —80 volts, at which the controlled valve would be cut off. By using a pentode as the D.C. amplifier, it is posible to

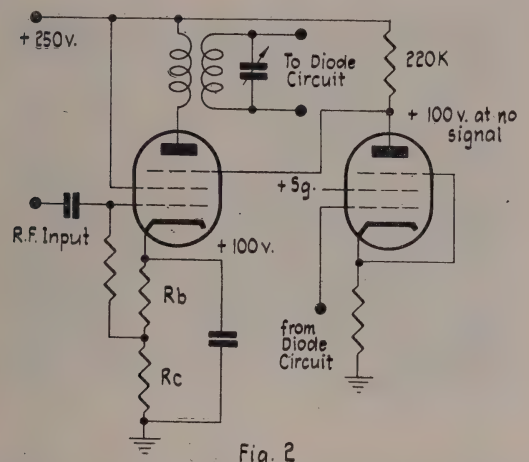


Fig. 2

obtain a D.C. gain of about 100 times—nearly as much as the audio gain that can be extracted from the same tube, when used with the same value of load resistor, but to do this, special arrangements must be made.

For instance, if the D.C. amplifier is given a cathode resistor in order to fix its no-signal bias, and therefore its no-signal plate current at the desired value, this resistor will also provide negative feedback, thereby reducing the D.C. gain. We must remember in this connection that no amount of bypassing will prevent a cathode resistor from doing this. The alternative is to connect the cathode to some positive potential that does not vary sensibly whatever the conditions inside the set. One good way of doing this would be to place a tapping on the cathode resistor of the output stage. The current through the voltage divider so formed is determined almost entirely by the output valve, so that variations in the current passed by the D.C. amplifier itself will not affect the voltage at its own cathode, and the negative feedback is eliminated. A similar effect is caused if the screen is fed from a dropping resistor, so that the screen of the D.C. amplifier must also be fed from a point of fixed potential. A convenient point in the present instance is the cathode of the controlled valve, which as the curves of Fig. 1 show, will vary very little.

If the D.C. amplification is, say, 100 times, then if 50 volts bias cuts off the controlled stage, a signal at the A.V.C. rectifier of only half a volt peak will be sufficient for full control. This shows that a simple T.R.F. consisting of one R.F. stage and the diode rectifier (which would also do duty as the signal detector) would easily be given as good an A.V.C. action as a five-valve superheterodyne!

SUITABLE VALVES

Suitable valves for this sort of arrangement are the EF50, the EF91 and the American 6AK5 and 6AC7. The main consideration is that the valve used, in addition to having a high mutual conductance, must have a relatively short suppressor-grid base, otherwise too great a signal will be needed to cut it off. From Fig. 1, it can be seen that the arrangement automatically gives the same effect as a conventional A.V.C. system with a voltage delay applied to the A.V.C. diode. The effect of the delay voltage is to prevent the diode from conducting, and therefore from producing any A.V.C. voltage, until the signal has reached a pre-determined level. The object of this is, of course, to ensure that for small signals, up to the predetermined level mentioned, there is no reduction in the gain of the receiver. In this way, the receiver's weak-signal performance is unchanged in spite of the use of A.V.C. Here, the effect is auto-

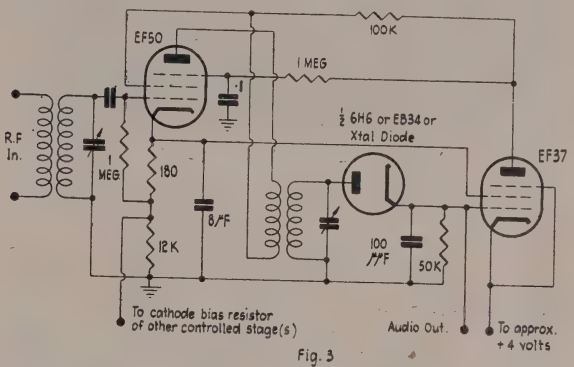


Fig. 3

matic, because for a considerable initial negative suppresor bias, nothing happens to the current distribution in the valve.

We have illustrated the case of only one controlled valve, but there is no reason why any number cannot be controlled in the same way.

CONTROL OF MORE THAN ONE VALVE

It might be thought a disadvantage that the method we have been describing obviously decreases the plate voltage available. In the example shown, the supply voltage is 250, but no more than 150 of this can be applied to the valve between plate and cathode. Reference to the characteristics of most high slope pentodes will show that the actual plate voltage used has very little effect on the performance of the valve. The main thing so far as stage gain is concerned is to see that the plate current is kept up to the normal value. Indeed, for this circuit, there is an advantage in reducing the maximum plate and screen voltage by including resistance in the cathode circuit, because, by this means, we can ensure that when the plate current is cut off, and all the cathode current is flowing to the screen, the screen dissipation is not exceeded. In applying the method, this is the only thing that needs to be watched.

Now, the value of the cathode resistor required to put the cathode at a positive potential of 100 volts depends on the normal plate and screen currents when the plate and screen voltages are both 150 volts. This can be found from the valve data books, and the value of cathode resistor worked out in the usual way. The cathode bias resistor (R_b in Fig. 1) is found in the usual way, and by returning the grid leak to the junction of this and R_c, the proper grid bias is provided in spite of the large voltage between cathode

(Continued on page 53.)

CLOCK THAT DOESN'T TICK

By L. T. SARDONE

Since 13th November, 1954, Australia has become the proud owner of a real "time machine": an electronic clock that is the most accurate of its kind in the world, correct to within 1/100th of a second.

Behind this new telephone time-service lies a modern triumph of inventive ingenuity.

For many years, post offices in the larger countries provided a time service where a live telephonist gave the correct time, as required. In both Sydney and Melbourne a staff of twenty telephonists, working 24 hours daily in half-hour shifts, provided subscribers with the time.

But the first automatic time service came when the Rome Post Office, Italy, installed a speaking clock in 1931. Later, speaking clocks were installed in Paris, Norway, Denmark, Sweden, Finland, and Poland. London opened its well-known speaking clock service "TIM"—where subscribers dialled TIM for time —in 1936. TIM became one of the most popular clocks in the world, rivalling even Big Ben itself.

Thus Australia was able to survey the entire field and twenty-three years' experience before adopting a similar clock.

This it did on 13th November, 1954, when "George," as the Sydney clock is affectionately known, came into operation. Melbourne's clock began a week later, on 20th November. George's first official time announcement in Sydney was: "At the third stroke, it will be two, one and 40 seconds." He followed the last announcement given by a live operator at the Sydney G.P.O., Miss E. L. Ryan-Bryce. She retains the honour of giving the last live time signal announcement at 1½ minutes past two, 13th November, 1954.

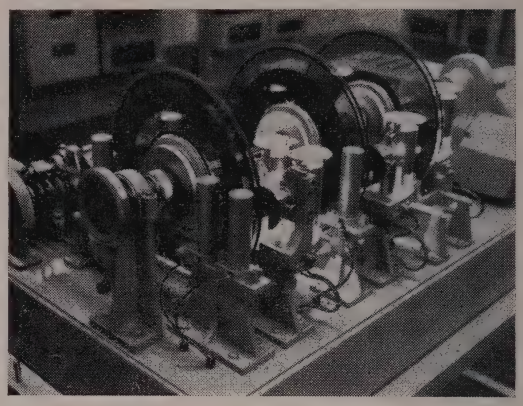
George's voice is actually that of a London free-lance radio announcer, Mr. Norman Gow, who made the tape recordings of the time announcements which were later incorporated in the clock mechanism.

A man's voice is used in the Australian clock because it was found in Britain, where a girl's voice is used, that the limited frequency range of the telephone does not give maximum clarity for the higher-pitched voice. The voice of Britain's speaking clock is that of Miss Jane Cain, the "Girl with the Golden Voice," chosen from among 15,000 telephonists.

Australia's speaking clock does not "tick", the pendulum of the ordinary-type clock being replaced by a quartz crystal oscillator activated by electric current. Further, a dial is not an actual necessity, although one is provided for the assistance of technicians in charge, in addition to a loudspeaker continuously operated in the clock room.

The installation comprises two complete clocks in both Sydney and Melbourne G.P.O.s. one working and one stand-by with emergency power supply. Change-over is carried out automatically should the mains supply fail. In addition, every 24 hours the clock automatically adjusts itself to an incoming correction signal from Mt. Stromlo Observatory, Canberra, via the Melbourne P.M.G. research laboratories.

The aspect of greatest interest to the public using the service is the speaking mechanism.



Close up of speaker mechanism, showing three glass discs with sound tracks, clock shaft and photo-electric cells.

Italy's speaking clock used the wire-recorder principle, while New York and other American cities use tape recordings. But the British and Australian system uses glass discs which carry the sound tracks much the same as the sound track is printed down the edge of a talking film.

A light shines through the varying width of the sound tracks, and the resulting fluctuations in the light beam are picked up by a photo-electric cell, which in turn converts the variations of light into a tiny electric current; this is fed through an amplifier, and the loudspeaker reproduces the original spoken word.

A time signal is given every ten seconds of the 24 hours, so that a total of 8,640 announcements are made every day and night. But Mr. Gow did not have to make anywhere near that number. Actually, he only made 94. Firstly, as the hours one to twelve are duplicated, only 4,320 are needed for 24 hours' service. Secondly, each announcement was not recorded as a complete sentence, but was divided into several parts which are recorded on the three separate glass discs mounted on the clock's motor shaft. The announcing machine motor is driven at a constant speed of 30 revolutions per minute from an accurate 50 cycles per second supply.

The result is that one disc carries the common phrases and the hours: "at the third stroke it will be nine——." The second disc carries all the minute announcements, "twenty-nine——," and the third disc carries the seconds announcements, "forty seconds," and the pulses or pips.

These announcements are so perfectly synchronized in sequence that, to the listener, it sounds like one smooth sentence: "At the third stroke it will be nine twenty-nine and forty seconds." The three pulses are of 1,000 cycles per second tone each one-tenth of a second long and spaced at one-second intervals. The start of the third pulse of tone marks the time stated in the announcement.

Service facilities are provided to answer up to 100 subscribers simultaneously. The relay sets which distribute the announcements to the telephone system provide means to prevent subscribers from talking to each other. They also provide for the automatic disconnection of subscribers who do not "hang up" within a period of 1½ minutes. This is designed to prevent the clock becoming continuously engaged during busy hours.

The service is available to all automatic telephone subscribers within the Sydney and Melbourne metropolitan areas who are charged a unit fee for each call made to the clock. However, a free service can be obtained with automatic public telephones by dialling BO74 in Sydney and MO74 in Melbourne.

The number of calls per day for this new time service for both Sydney and Melbourne average something like 42,000, while the record day occurred during the first week of operation in November, 1954, when 55,000 calls were recorded at Sydney G.P.O.

The speaking clock provides three other services. They are:

In Melbourne, a six-pip signal for the Railways Department every minute.

A special signal of three minutes' duration (called the XNG Signal) broadcast over the coastal radio station, VIM, for correction of ships' chronometers.

A time signal at 1 p.m. every day for subscribers who pay for this special service.

General view of clock room, Sydney G.P.O., showing clocks in dulpicate. Speaking mechanism cabinets in foreground. Ae rear can be seen other component parts with clock faces. Speaker cabinets are against both walls.

An ultimate refinement of the PMG automatic time service via its speaking clock would be a special radio station from which, at any time of the day or night, correct time would be announced at the mere turn of a dial.

However, that remains in the dim and distant future of scientific speculation. Until then, the Australian Post Office Speaking Clock will continue to function as one of the great wonders of this modern electronic age.

N.Z.A.R.T. NOTES

(Published by the Publicity Committee, N.Z.A.R.T., 25 Lees Road, Christchurch, to whom all enquiries should be addressed)

All members of the DX fraternity will rejoice in the news of AC4RF's release on 27th May last from imprisonment by the Communist authorities. Members will recall that for a considerable period AC4RF provided the only Amateur contact with Tibet. Unfortunately, he was imprisoned when political changes took place in that country, and with his close down, Tibet returned to the classification of "one of the impossibles".

In the Field Day Contest, the battle for the highest branch score was once again fought between the Franklin and the Manawatu branches, with the final honours going to the former, thus showing that they have not lost any of their organizational or operating ability. This duel is becoming an annual feature of this contest, and from a study of the methods of these two branches, some other branch might well give them a run for their money next year. On the whole, entries have improved, but there is the usual lack of South Island interest even though there is now a separate section for South Island stations.

The V.H.F. bands again came into their own at the Industries Fair at Christchurch. As is usual at shows of this nature, the noise level was considerable, and for work beyond the city limits operators at the Fair had to use a relay channel on 2 metres. Relay work was also done via 160. A special QSL card has been printed and will be distributed through branches to all contact stations.

Some time ago we mentioned Tony Willis's (ZL3GI) departure overseas. Now we learn of his arrival in Nigeria where he hopes to be on the air in the near future. Although contact with this part of Africa is somewhat intermittent, we hope that Tony will be able to hear the signals from down here through the QRM which must roll in from Stateside and Europe. However, ZLs. may rest assured that, if it is a choice between a ZL and an amateur from another country, some preference will be shown to the New Zealander. This will be one occasion when the rare DX will be operated by an ex-ZL.

The bands still seem to be on the upgrade. Ten has shown the odd mid-morning opening towards North Africa and the Mediterranean area. On some occasions the signal levels have been up to those experienced at the time when ten was at its best. As winter approaches, the length of the openings is increasing, so that ten should be watched for the next few months. Africans on 40 are still workable, though signal levels are decreasing. The peak occurs between 5 and 6 a.m. N.Z.S.T., but at this time there is severe interference from commercial transmissions. The latter are of the high speed variety, and the fact that they are in an exclusively amateur portion of the band does not seem to worry anyone, except the odd amateur! Overall activity on this band is low, and possibly this is the reason for the moving in of certain commercial interests. It should be realized that some classes are looking continually for free frequencies, and it is quite a goldmine to come across a nice slice such as an infrequently used amateur band. Once found, possession is soon taken, and if we are to retain our dwindling bands, then we must use them all the time. Otherwise we may be faced with a push such as was administered in the 1920's. This time, it will not be 200 metres and down!

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The PHILIPS Experimenter

An advertisement of Philips Electrical Industries of N.Z., Ltd.

No. 93: A Portable Transmitter-Receiver for the 160-Metre Band

INTRODUCTION

There is one amateur band which, in this country at least, seems to be almost unoccupied. We refer, of course, to the 160-metre band, and it seems rather strange that it should be so completely out of favour with amateur transmitters. Perhaps the reason is that it is so narrow. It extends from 1900 to 1925 kc/sec., which is as if the 80-metre band were only about 50 kc/sec. wide. By the same token, it is only a third as wide, in terms of percentage frequency, as the 40-metre band, and it seems a little peculiar that it should be one of those bands set down for general use while users of the 40-metre band require a high-frequency permit! However that may be, there seems little reason why the 160-metre band should not be made use of. Another reason for its unpopularity might well be its proximity to the broadcast band. If 100 watts on 80 metres causes BCL interference, one would certainly expect the same amount of power on 160 to be even more troublesome. This might be a contentious point, and so, to keep clear of it, we are about to describe a portable station which includes a transmitter putting just about 1 watt of R.F. power into the aerial. Moreover, we are quite prepared for such questions as, "What good can such power do on that frequency?" One has only to think of some of the DX feats of the past using powers even lower than this to realize that a whole watt of R.F is by no means to be sneezed at.

In particular, the equipment which this series of Experimenter articles describes has been designed specially for emergency or field-day use, for short-range communication during the day, and for short or long-range work at night. Both transmitter and receiver are operated from dry batteries, and have been made compact and light in weight. It is not generally realized that equipment of this sort, on the 160-metre band, should be equally as useful for short-range daylight working as V.H.F., with the added advantage that the low frequency makes one independent of line-of-sight propagation. In other words, where V.H.F. falls down is in providing communication between places that are separated by a high range of hills, or other similar obstruction. On 1900 kc/sec., however, we can make use, during the day at least, of the E layer of the ionosphere by directing some radiation vertically upwards. The E layer reflects it back, and because of the lowness of the frequency, and the "roughness" of the ionosphere, regarded as a reflector, what comes back to earth is effective over a quite wide area. Add to this the fact that we will be radiating at almost all angles of elevation, and it can be seen that as long as the E layer is present, communication can be established on this frequency without any "skip," over a large area centred on the transmitter. This convenient behaviour of the 160-metre band comes about because this frequency is below what is known as the "vertical incidence critical frequency" for the E layer.

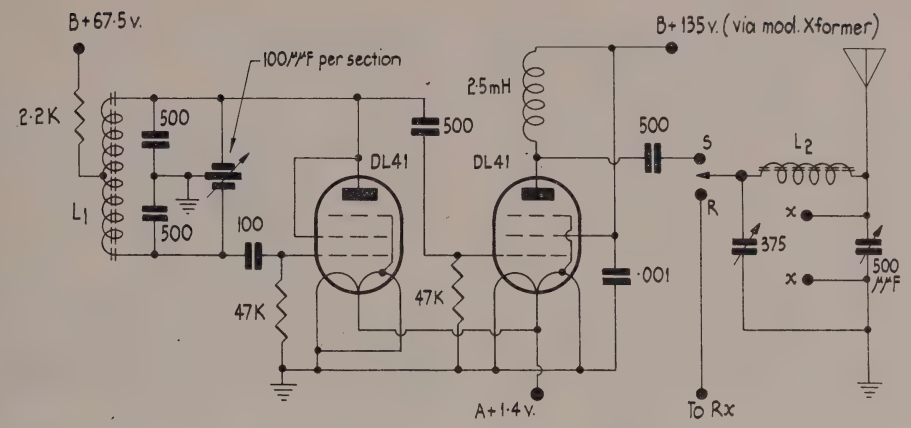
With this preliminary build-up, we hope that the extremely simple circuitry we have designed will encourage at least some "hams" to tackle what is certainly an orphan band.

THE TRANSMITTER

The first portion we propose to describe is the transmitter. Since our gear is to work from dry batteries, we immediately fall between the twin stools of low power output and high current drain. Preliminary investigation showed that a Philips DL41 could produce an output of just under one watt with a plate input power of 1.3 watts. This, in terms of B battery usage, means a current drain of approximately 10 ma. at 130 volts, for the plate alone, together with 3 ma. or so for the screen. Add to this 5 ma. for the oscillator which is to drive the power amplifier, and we find that some 18 ma. is drawn from a 135-volt B battery for the R.F. end of the transmitter. This seems high, but one could hardly expect better efficiency from battery-operated valves. In addition, one must remember that the efficacy of any battery-operated device is not only a matter of the latter's consumption, but also of the batteries which are chosen to power it. For instance, if we were to use the smallest size of Minimax B battery to power the transmitter, it would hardly be fair to expect the same sort of life as the same batteries give in a four-valve receiver with a total drain of seven or eight milliamps.

For modulating the transmitter, we have decided on two DL41s in Class B. These will effect great economy in B battery drain, because the average plate current of the modulator will be no more than needed to give the required power output of about 0.75 watts on peaks of modulation. Moreover, the modulator valves will be interchangeable with those in the R.F. end of the transmitter, thus making for easy replacement in the field. With the Class B_1 modulators excited by means of a push-pull input transformer, and driver valve, it will be a simple matter to obtain full modulation with a carbon microphone. If desired, an additional stage of amplification can be used in order to make a crystal microphone usable.

The use of a push-pull modulator makes it more or less impracticable to use the same stage as the power output stage of the receiver, as is often done



with transceivers. Besides, the omission of all circuits which have a double function makes the construction of the equipment very simple and straightforward. Readers will notice that, although the transmitter uses four Philips DL41s, we have already taken pity on their pocket-books by offering these excellent battery types at a very much reduced price!

THE RECEIVER

The receiver, which will be described later on in detail, will be a superhet. of a very simple type, using what we think are one or two rather cunning dodges, which will actually make the construction less difficult than if we had used a T.R.F. circuit. There will be an oscillator-mixer, using the Philips DK40, an I.F. stage using a Philips DF91, a regenerative detector-cum-B.F.O. employing a further DF91, and a stage of audio amplification, feeding a pair of headphones. The receiver will thus be a low-drain one, which is as it should be, for the greater part of the operating time will probably be spent on "receive," with brief interludes on "transmit." It is for this reason that we have not worried unduly about low drain in the transmitter, preferring a reasonable power output to cheeseparing on H.T. and filament drain. An advantage of battery-operated gear like this is that the quick warm-up of the valves can be made excellent use of in saving battery power. Whatever the position of the send/receive switch, there is no need to leave the filaments of the other unit on, since the valves come up to temperature almost instantaneously. Those who are not interested in 'phone operation will note that we have catered for their tastes without sacrificing simplicity. All the C.W. enthusiast needs to do when building the equipment is to leave out the speech amplifier and modulator circuit, and the Phone/C.W. switch, and build the rest "as is." On C.W., battery usage will be very much better, since the H.T. drain of the transmitter is so very intermittent, even while it is in use. It should therefore be possible to use the smallest Minimax B batteries with every satisfaction, and with quite long life.

TRANSMITTER DETAILS

The circuit of the transmitter is given in Fig. 1. The oscillator is a Colpitts, with a low L/C ratio in the interests of frequency stability. We would have used crystal control but for the difficulty of obtaining crystals for the frequency. If anyone should have a suitable "rock," he would be well advised to use it. Any of the ordinary circuits could be used, and the Philips DL41 would remain as an excellent valve for the purpose. The only firm requirement is 0.5 ma. driving grid current for the final, and this is not difficult to obtain. However, in the absence of the crystal, a high-C Colpitts will do very nicely; not as well as a Clapp, of course, but one can't have everything, especially in portable equipment if it is to remain so. The order of stability provided is quite adequate, and the keying characteristics are surprisingly good. The main tuning capacity comprises two 500 $\mu\mu$f. condensers in series across the coil, with the small trimming condenser for frequency setting. The variation in frequency possible with this arrangement is small, but this has been done purposely so as to reduce the possibility of off-band transmission when the equipment is in the field, away from accurate frequency-measuring gear. The final amplifier is excited by capacity coupling to the plate end of the oscillator circuit. This connection tends to counterbalance the connection of the oscillator grid circuit at the other end of the tuned circuit, and helps to preserve accurate capacitative and resistive balance with respect to the centre-tap of the tuned circuit.

The oscillator H.T. voltage of 67½ is used because this gives as much power output as is required to drive the final. It would have been possible to use the full 135 volts for the oscillator plate feed by increasing the size of the decoupling resistor, which would then act as a dropping resistor as well. The advantage of so doing is that both sections of the B battery would then be loaded equally, and there would be no tendency for one to become used up earlier than the other. However, the idea has the disadvantage that power is wasted in the droping resistor. It was considered more important to save this, because it is possible to equalize the drains on the two halves of the B battery by changing the sections round at intervals.

Output from the transmitter is by the well-known pi-section coupler, which has several advantages for this kind of transmitter. In the first place, the aerial will always be a single-ended affair—either a short whip or a length of wire of any convenient length hitched to a tree or some other conveniently high object. Under these conditions, some means of aerial matching must be used which enable a wide variety of impedances to be coped with. The power output being very low makes aerial matching all the more

important. The pi-section filter enables this desirable condition to be brought about. A further advantage of the output circuit is that it discriminates strongly against harmonic radiation. In this particular case, the second harmonic would cause interference to those working on the 80-metre band, and considerable confusion and annoyance could be caused if the 80-metre output were appreciable. Another advantage is that, on the 160-metre band, the output coupler for the transmitter can also be used as an input tuner for the receiver. This is a most unusual feature, which is made possible by the extreme narrowness of the band. If the coupler is to be used as an aerial tuner for the receiver as well as an output coupler for the transmitter, its adjustment must remain unaltered when the transmit/receive switch is operated, otherwise it will be necessary to re-tune the circuit every time the switch is moved, in either direction. With a very narrow band, however, this can be avoided. Supposing that the transmitter is tuned to the centre of the band, and that the output tuner is not touched when it is switched to become the first tuned circuit of the receiver. It is well known that the 3 db. bandwidth of a tuned circuit can be found by the expression f_o/Q, where f_o is the centre frequency, at which the circuit peaks, and Q is the Q-factor of the circuit. Here, we know that the centre frequency is 1912.5 kc/sec., and that the coil itself can have a Q of 100 or so. Under these conditions, the bandwidth for a 3 db. drop in response compared with the centre frequency would be 19.125 kc/sec., or 9.56 kc/sec. either side of the centre of the band. This would not be quite wide enough, but we can hardly guarantee that the aerial will not introduce losses on its own account and reduce the Q of the circuit below that of the coil itself. For a 3 db. bandwidth of 25 kc/sec., the Q of the circuit under working conditions must be 76.5. If the bandwidth is found to be not quite great enough with the aerial connected, it will be possible to increase it to any desired extent simply by adding resistance from grid to ground in the first valve of the receiver. As little shunting as possible should be used, of course, because the farther the Q of the circuit is reduced the smaller the voltage step-up the circuit will provide, and in the "receive" position we want as much as possible. However, the idea is a perfectly practical one under the available conditions, and will give good performance with much simplification of circuitry. The receiver is to be without a stage of R.F. amplification, as mentioned earlier, so that, with the fixed-tuned aerial circuit, using the transmitter's pi-coupler, the only continuously tunable circuit in the receiver will be the oscillator. This arrangement avoids altogether the use of a gang condenser, and makes it possible to build the receiver very compactly. At the same time, there will be little or no sacrifice in performance compared with a conventional receiver input circuit. The latter will actually be much simpler and easier to construct than a T.R.F. would be, and its performance should be superior.

(To be continued.)

MISSING AND STOLEN RADIOS

DARGAVILLE:

DELCO single unit auto radio, painted fawn, with small square dial.

AUCKLAND:

PHILIPS battery/electric portable radio, serial No. 76903/104391, maroon plastic case with strip of white beading round front, four control knobs.

CROMWELL 5 valve radiogram, serial No. 31751, dark oak cabinet with two selector knobs.

PACEMAKER 5 valve battery/electric car radio, cream case 15 in. x 10 in. x 6 in. with gold rim round dial. Operated by lifting and closing lid.

SKYSCRAPER car radio, brown steel cabinet 9 in. x 6 in. x 4 in. with bakelite front and two white tuning knobs. Two screw holes to fasten radio to dashboard.

STYLEMASTER broadcast model car radio, brown bakelite case 12 in. x 6 in., with two chrome bars across front and two tuning knobs.

H.M.V. car radio, serial No. either 30722/24512, 30640/245656 or 3170/98794, grey cabinet with two black tuning knobs and oblong dial.

AERIAL 7 valve 6 volt car radio, serial No. 4465, brown cabinet 9 in. x 8 in. x 2 in. x 5¼ in. with plastic dial. Receiver and speaker combined. Two tuning knobs.

PHILIPS portable model 546, serial No. 76700, maroon cabinet.

MOUNTJOY 6 valve mantel radio, serial No. F7723, dark oak cabinet 24 in x 12 in. with honey oak inlaid strips and white dials.

ROTORUA:

ULTIMATE 5 valve radio. Serial No. 80557.

ROLLS 5 valve mantel broadcast radio, serial No. 47744; 8 in. speaker and three tuning knobs. No cabinet.

AUTOCRAT 8 valve car radio, serial No. 10763, brown metal case.

NEW PLYMOUTH:

FIVE STAR battery/electric portable radio, brown lacquer cabinet 14 in. x 7 in. x 10 in., with carrying handle on top of lid. Lid opens to expose dial set in cream top face. Power, battery, tuning and tone control knobs. Louvres at back of case.

WANGANUI:

BELL 5 valve broadcast radio, serial No. 9054, green plastic cabinet 8 in. x 6 in. x 4 in., with three control knobs and dial 4 in. x 4 in. on front.

PALMERSTON NORTH:

PACEMAKER battery/electric portable, serial No. 80141, dark green case with white plastic grille which has a crack.

WELLINGTON:

PYE portable radio model 65, serial No. 52427, metal case of mottled blue 16 in. x 13 in. x 5 in., front and back of blue-grey bakelite, open dial, broadcast only, two tuning knobs and two sliding control switches, plastic handle.

CHRISTCHURCH:

CLIPPER, 5 valve dual wave mantel radio, model 524, serial No. S/N. 53756, cream and red cabinet.

Portable home-made battery radio in wooden cabinet covered with red rexine.

PHILIPS portable battery/electric radio, model 546, serial No. 76853/104626.

AUTO portable car radio, grey, chrome handle over top, four knobs.

PHILIPS battery/electric portable in green rexine covered case.

PHILIPS 4 valve broadcast radio, model 146, maroon bakelite case with cream front.

PHILIPS 5 valve broadcast radio in brown bakelite cabinet.

APPLIANCES RECOVERED

PHILIPS model 146, 4 valve mantel radio, serial No. 4860/68486.

SUNBEAM electric cake mixer, serial No. S374895.

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NEW RADAR AND TELECOMMUNICATION CONTROLS

London Airport, the busiest airport in Europe, handling 1,724,000 passengers in 1954, entered a new phase in April on completion of the new control tower and a section of the passenger-handling building, forming part of the new central terminal area.

Owing to the London newspaper strike, very little was heard there of what was a considerable British achievement in planning and in civil, mechanical, electrical, and electronic engineering. The telecommunications system, for instance, is said now to surpass that at any other civil airport in the world. The Airfield Surface Movement Indicator (ASMI) is believed to be the first permanent installation of this type of radar at a civil airport.

In the new tower, rising 127 feet up from the heart of the new central terminal area, is an air traffic control unit capable of handling 50 or more movements an hour at peak periods. Aircraft flying to and from the airport and all movements on the runways, taxiways, and aprons are controlled from the tower. All the lighting needed to enable a pilot to make a visual approach to the airport, descend to the runway, land, and taxi to the unloading area is also (with minor exceptions) controlled by switches in the tower.

Radar is being used more and more in controlling the movements of aircraft. A surveillance set watches the approaches to the airport. This British equipment has a maximum all-round range of 60 miles; but it will be used under normal conditions on the 10 and 20-mile ranges. Plan position indicator (PPI) displays are employed, and the equipment incorporates moving target indication (MTI) circuits by means of which the permanent echo clutter can be removed from the displays, leaving only the responses from moving targets.

In the approach control room in the tower there are two radar controllers—one guides aircraft, through his radio communications officer who sits alongside, from a radio fix at Epsom and directs them on to the approach path to the runway; the other controller guides aircraft from a radio fix at Watford and directs them at safe intervals on to the same approach path. In this way, in bad weather, aircraft can be landed at the rate of about 20 an hour. About six or seven miles from the runway the radar controllers hand over the aircraft to the talkdown controller, who directs or monitors the aircraft to a position from which a landing can be made. The talkdown controller (GCA) is at present housed in a caravan near the runway, but later he will be placed in the control tower. A British landing system (ILS) is also installed at the airport.

Movements of aricraft and vehicles on the airport, except those on the runways in use, are the responsibility of the ground controller in the glass penthouse at the top of the tower. Because of the complex taxiways leading from the runways and maintenance areas, the ground controller's task calls for a more elaborate method than the use of the radio-telephone. At periods of peak traffic, runways and taxiways must be kept clear in all visibilities; to achieve this the controller looks at a small-scale model of the lighting system of runways and taxiways, selecting the route for the pilot or vehicle driver to follow, and switches on the appropriate lights. Simultaneously the selected route lights up on the model.

NEW RADAR SYSTEM

In bad visibility, the controller watches these movements on the airfield surface movement indicator. This equipment, also British, operates in the Q-band (eight millimetres) and scans the airport with a very narrow beam of one-third of a degree and detects the target with an ultra-short pulse of one-twentieth of a microsecond. These unique characteristics, combined with good circuit and display designs, produce a picture of the airport in which every feature is sharply and clearly defined. The runways are revealed with photographic precision, and all traffic, moving and stationary, on the runways and perimeter track is accurately plotted.

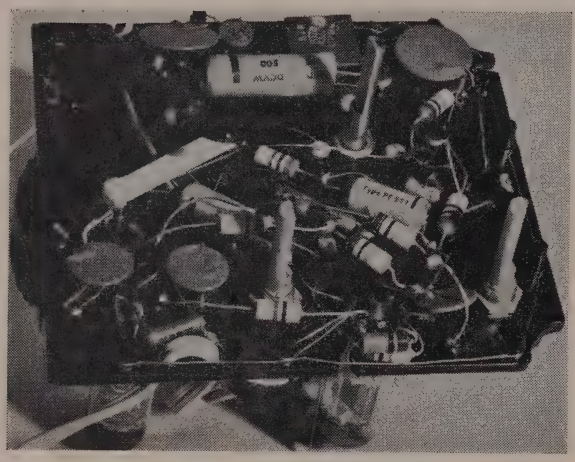
Aircraft about to take off are the responsibility of the air controller. He is assisted by a radar controller who can watch aircraft for a short while after they are airborne, and, by knowing the exact position, the air controller can dispatch successive aircraft with a minimum of delay; in good weather he is also responsible for aircraft landing.

Elaborate telecommunications facilities are also provided in the new control tower. A listening watch is maintained continuously, and all appropriate services are advised in advance of an aircraft's arrival so that customs officers are ready for the passengers and all other needs met, including the refuelling bowsers to replenish the aircraft without delay.

All radio conversations between ground and aircraft are recorded on tape on eight-channel British equipment which is running continuously. These are some of the facilities already provided; there is room in the control tower for additional services and there is confidence in the system, which has been designed to keep abreast with the steady expansion of the world's civil air services.

Suppliers of radio and telecommunications equipment include Burndept, Cossor, Decca, G.E.C., Marconi, Plessey, Pye, Standard Telephones and Cables, and the Telegraph Construction and Maintenance Co.

5-VALVE COMMERCIAL RECEIVER USES NEW MANUFACTURING TECHNIQUES

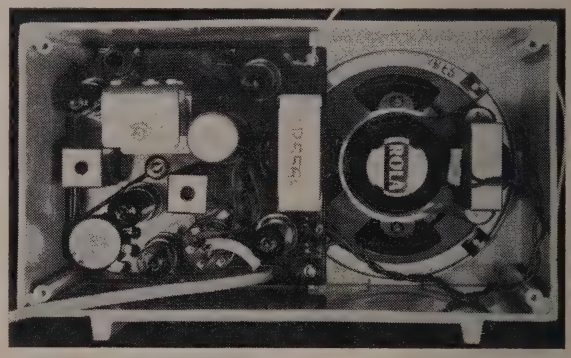


We have often been asked for our opinion on the possible use in this country of printed circuits for domestic receivers, and whether the use of such modern methods would not drastically reduce the price of sets. Our answer has invariably been that production runs in our factories are usually far too small to make tooling up for advanced methods of construction economic. This view is still, we think, fundamentally correct, but the fact remains that we have in our very midst today a receiver which, if it does not use printed circuitry, does represent a step forward in economical production. We refer to a little five-valve set produced by Messrs. Collier & Beale. Plastic-moulded cabinets for small sets are now so commonplace as to excite little or no comment, but this one not only possesses a plastic cabinet, but also a plastic chassis!

A PLASTIC CHASSIS

The photographs which appear on this page give some idea of the unconventional lay-out of the set, and show quite clearly how it is built on a plastic moulding, which is mounted vertically in the cabinet by screwing it to three moulded-in supports in the cabinet itself. The cabinet is approximately 9½ in. x 5¼ in. x 5¼ in. deep, and the chassis moulding is a shade over five inches square. All the main parts except the gang condenser and the controls are mounted by means of turn-over lugs, and not a single screw is to be found threaded into the chassis. All wiring is done with bare tinned copper wire—a feature which is made possible only because the chassis is of insulating material. The underneath photograph shows how cunningly contrived posts and lugs, which are integral parts of the chassis moulding, are used as tie-points, so that no insulated soldering lugs have to be mounted as tie-points. In this way, pieces of the bare hook-up wire, and the flexible leads of the components themselves are anchored simply by taking a turn or two round the appropriate post. The same method is used where a wire has to change direction, and by this means all loose leads are prevented from occurring. It is virtually impossible for any wire to sag, or to touch any other component or wire when this system is used. As an aid to the operatives assembling the set, most of the runs of wiring are indicated by moulded-in ribs. Even the heater wires are run bare, by the simple expedient of putting one on each side of the chassis. One of them also acts as the earth bus for the whole set.

The circuit of this set also displays some unusual features. The most obvious of these is the omission of an H.T. winding on the power transformer. In fact, the power supply represents a half-way house between transformerless operation and the conventional system. This idea has much to recommend it. Most of the disadvantages of the transformerless set can be put down to the series-heater part of the circuit, necessitating as it does in 230-volt areas, a dropping resistor in the A.C. line. Heat dissipation in this resistor is a serious problem, and all the common dodges for avoiding its effects are less desirable than eliminating it altogether, as has been done here. Not the least important advantage of the "mixed" technique is that the power transformer, being a filament transformer only, is much smaller than usual, and dissipates much less heat on its own account. This again limits the temperature rise in a small set, and enables it to be made smaller still.



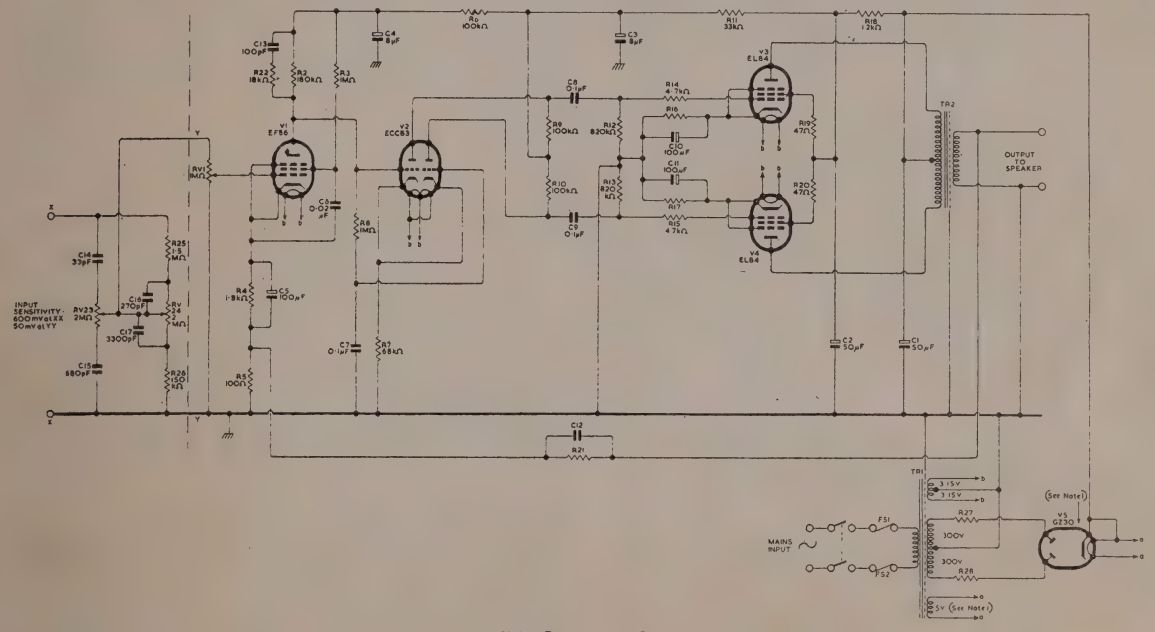
Showing the set installed in its cabinet.

Another useful feature is the limitation of the power output to approximately 1 watt. Not only does this power provide ample drive for the small loudspeaker, but it also enables a lower hum-level to be attained. This comes about because a two-section RC filter can then be used, with the plate of the output valve fed from the first section, and the screen of the output valve, together with the remainder of the set, from the second section. The extra smoothing thus applied to the screen-grid of the output valve results in a considerably lower hum-level than is attainable otherwise unless larger filter capacities are used. It can thus be seen that the designer has incorporated features which, while not detracting in any way from the performance, do assist in reducing the cost of components.

Altogether, this little set is an excellent example of skill and ingenuity in design, and Messrs. Collier & Beale Ltd. are to be congratulated in pioneering new techniques in this way.

Mullard 5-Valve 10-Watt High- Quality Amplifier Circuit

Several prominent valve manufacturers have recently brought out amplifier circuits in order to encourage the sale of valves to amateur constructors and others. These circuits have been carefully worked out in the makers' laboratories, and should be capable of excellent results in the hands of even inexperienced builders. This month we have pleasure in presenting the circuit of Messrs. Mullard's amplifier, for which a detailed instruction book is on sale in radio parts dealers' shops. The keynote of the Mullard circuit is quality at reasonable cost, and while no one would claim the ultimate in high-fidelity results, this circuit should find a ready "sale" among enthusiasts with limited depth of pocket. The local Mullard agents, Messrs. C. and A. Odlin Timber and Hardware Co. Ltd., have arranged for supplies of power and output transformers to be available, built to the exact Mullard specification.



NOTES

(1) The EZ80 may be used instead of the GZ30 provided the current drawn does not exceed 90 mA. Sine wave testing up to full output power cannot be undertaken when the EZ80 is used, and also this rectifier should not be expected to supply the additional current required for other units used in conjunction with the amplifier. For the EZ80, the heater winding a-a must supply 6.3v.

If sine wave testing is to be employed for outputs up to maximum power, type GZ30 must be used and a 5-volt-heater winding will be required. The GZ30 can be made to supply additional power for F.M. units, etc.

(2) The total limiting resistance, Rlim, in series with each anode of the rectifier must be at least 47Ω for the GZ30 or at least 215Ω for the EZ80. The amount of series resistance Rt contributed by the transformer is:

$$Rt = Rs + n^2Rp$$

where Rs = resistance of half the secondary
Rp = resistance of the primary
n = ratio number of turns on half the secondary to number of turns on the primary.

Thus, if Rt is less than Rlim, then R27 and R28 should each be chosen with a value equal to the difference between Rlim and Rt.

(3) For a sine wave input, R16 and R17 must both be 270Ω. If, however, the amplifier will only be used for speech or music inputs, the alternative value of 437Ω (= 390Ω + 47Ω) can be used, together with a primary load of 6,000Ω.

(4) C12 and R21 must be chosen to match the loudspeaker according to the following table:—

Speaker impedance (Ω)	C12 (pF)	R21 (kΩ
3.75	180	15
7	120	22
15	82	33

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RECORD TALK

By JOHN GRAY

Many years ago Constant Lambert wrote about "the disappearing middlebrow", implying that the world of music was resolving itself into two separate and irreconcilable camps, comprising the followers of Bach and of Bop. The truth, of course, was the same then as it is now; the bulk of the populace are people whose tastes lie comfortably beween the two extremes and it is they who seem to have been least catered for in the matter of recordings during these recent years. The highbrow, and the tin pan alley addict, have an abundance of material from which to choose. The poor middlebrow asks in vain for some old favourite once available at the antique speed of 78 rpm, and generally asks in vain.

But, provided he can accustom himself to buying his wants in batches of half a dozen or more at a time, the middlebrow can nowdays find much to gratify him. There are, for instance, two new Argo LP discs, marketed here by the Delta Trading Company, which were expressly designed for him. On RG 53 that grand baritone Dennis Noble delivers himself of a dozen staples from the ballad singer's repertory. They are all here: from "Until" and "I'll Sing Thee Songs of Araby" to "Father O'Flynn" and "The Old Brigade". A good record for Father's Day when it comes along, and you can have full confidence that Dennis Noble and his accompanist Wilfred Parry know very well what they are about. RG 40 is a similar disc for adherents of the light orchestral classics. Eric Robinson, conductor of the B.B.C.'s television "Music for You" programmes, directs a group of favourites such as "In a Monastery Garden", "Melody in F", and even an arrangement of that old musical comedy standby, "Come to the Ball". Argo records for a more specialised public include two of topical interest—the Delius sonata No. 2 (RG 47) and the Walton Sonata (RG 48) played by our recent visitors Max Rostal and Colin Horsley. In a way it is a pity these two sonatas could not have been coupled on one disc. Purchasers of the Delius receive also that composer's cello sonata (Anthony Pini and Wilfred Parry), while the Walton sonata is backed by Walton's piano quartet, played by the Robert Masters' ensemble, who also visited us, some years back. Arnold Richardson plays a collection of Mendelssohn's organ music, including the six sonatas, on RG 30 and 31, and on RG 27 Cecil Day Lewis reads passages from Virgil's "The Georgics". This must rank with Arda Mandikian's "Ancient Greek Hymns" on H.M.V., and with such passages from the Bible as have been recorded, as among the most ancient samples of the arts of mankind to be put on records.

Delta are the local agents for Deutsche Grammophon Gesellschaft, the German firm which has replaced the pre-war Polydor company. The most interesting manifestation from this quarter is their "Archive Production", a huge enterprise formed to record a "History of Music", starting of course with Gregorian Chant, and proceeding up to the year 1800 by a sequence of twelve "research periods". This sounds both comprehensive and involved, but an attractive feature is that music from all these chosen periods is released more or less simultaneously within one batch of records, and those whose interest lies nearer the 18th than the 10th century do not have to wait until 1960 for the series to get around to their sort of music. The first release includes the expected plain-song (disc AP 13005) some vocal music by Monteverdi (APM 14020), chamber pieces by Corelli (APM 14024) and the complete Handel Water Music (APM 14006). Performers are German artists, ranging from comparatively unknown string players to well known singers like Fischer-Dieskau and orchestras like the Berlin Philharmonic. Three separate releases are already announced, and those interested should lose no time in investigating one of the most thorough projects in the history of recorded music. There are also Deutsche Grammophon releases of ordinary catalogue standbys as well as of Carl Orff's exciting choral suite, "Carmina Burana" (DG 16045-6), but lack of space prevents further discussion this month.

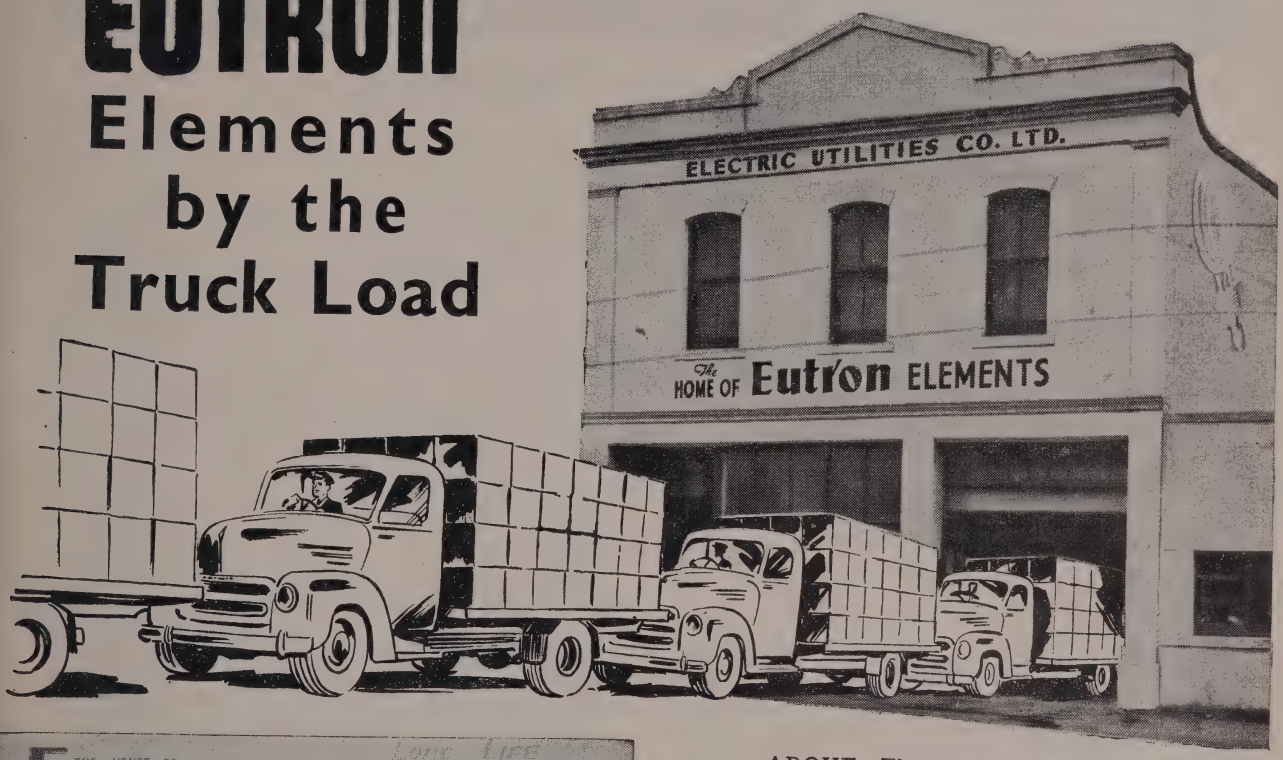
Instead, we descend to Tin Pan Alley, from which emerges the bread and butter of the record business, for the sale of its products has from time immemorial helped to finance those of the higher musical spheres. In other words, production of some expensive work by Berlioz or Mahler is often made possible by the profits on Johnnie Ray or Stan Kenton, and it's an interesting point that several American LP companies, formerly marketing only serious music, have recently extended their scope to include popular and jazz. Is the popular singer now being succeeded in general favour by the small usually male, combination? We find the hit parade favourites gradually falling into the hands of the Four Knights, Four Aces, Four Coins, Crew Cuts, Ames Brothers, Gaylords, Cheers, all of them small and highly dextrous vocal groups, with a vim and bounce which would perhaps startle their predecessors of the "Sweet Adeline" period. The Four Knights lead off with "Honey Bunch" and "Walkin' in the Sunshine" on Capitol CP 397, while The Cheers, a trio of students from California, have struck oil with their debut disc of "Bazoom" (CP 371). Radio Corporation have another potential best seller in the first record on which Frank Sinatra combines with Ray Anthony's Orchestra; the hit parader "Melody of Love", which is a tune in that medium waltz time that has always appealed strongly to New Zealanders. Its backing on CP 394 is "I'm Gonna Live Till I Die", a statement of the obvious which is nevertheless put across with something like conviction. Those who like a flowing, well orchestrated tune, may be directed confidently to Les Baxter's version of "The High and the Mighty", backed by the French number "Gigi" (CP 355). Tex Ritter tells the rollicking tale of "The Bandit" on CP 366, and Vicki Young sings a coupling of two more up-to-the-minute hit paraders on CP 396. These are "Hearts of Stone" and "Tweedlee Dee". Of Capitol LP records, CLC 040 ("Starlight Concert" by the Hollywood Bowl Symphony Orchestra) fits into the category about which I wrote at the beginning of this article. Once again it is a collection of sure-fire favourites, from "Finlandia" to "None But the Lonely Heart" and "Flight of the Bumble Bee", played by an orchestra which is undoubtedly the Los Angeles Philharmonic in disguise.

Festival have issued a complete catalogue that is a credit to whoever compiled it, including a page on microgroove records which should not go amiss. Such elementary precautions as never touching the surface of a microgroove disc with your fingers, and not stacking them in a heavy horizontal pile (shop assistants take note!) are still not universally heeded. In the more recent Festival releases is an extended play 45 by that volatile artist Pearl Bailey (XP45-447), whose appearance in "Carmen Jones" has acted as a stimulant to sales of her records. On the same speed you will find Louis Armstrong and Ella Fitzgerald (XP45-479), Tony Martin (478) and Tommy Dorsey (617). On LP, Festival have captured that beloved artist of the English stage, Beatrice Lillie, some of whose most celebrated numbers may be enjoyed on CFR10-511. Other attractions are folk songs from Terry Gilkison (10.554 and 566) and a fascinating disc of Trinidad calypsos sung by one Wilmoth Houdini on 10-568. Guy Lombardo is in his familiar form on 10-528, while Abe Burrows seems to be taking a leaf out of Anna Russell's book on his disc of "Type Songs" (10-552). We are told that he makes a "merciless assault" on various kinds of popular ballads, torch tunes, memory songs and so forth. This sounds familiar! Some of his titles such as "The Girl with the Three Blue Eyes" and "The Pansy in My Garden" are calculated to arouse lively anticipation. Of the Festival classics, CFR 10-576, a German performance of Stravinsky's "Les Noces" or "The Marriage", is the only version available here of one of the most significant of Stravinsky's works, set for voices, four pianos, and percussion. The performance originated in Dresden and is conducted by Fritz Schreiber.

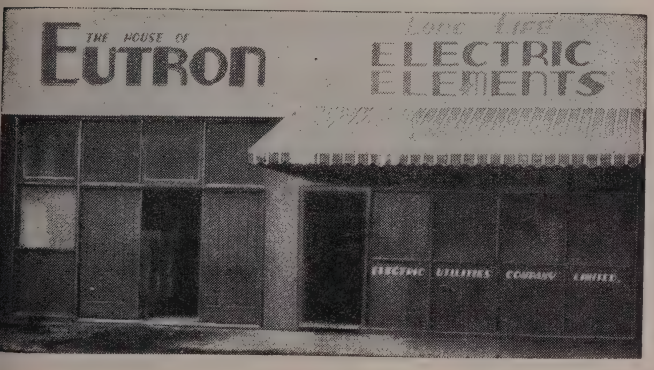
Philips are spinning their vocal group, the Four Coins, in "Maybe" and "I Love You Madly" (B 21513) while Jo Stafford and Frankie Lane really let themselves go with "High Society" (B 21514) and Percy Faith is among the first on the local scene with the new tango tune "Blue Mirage" (B 21517). Sammy Kaye's version of "Melody of Love" (B 21523) and Judy Garland's "Man That Got Away" (B 21383) are also to be had, while Liberace adds vocal and elocutionary talents to his keyboard dexterity on B 21540, on which he gives a new twist to "The Finger of Suspicion" and tells us that "I'll Get By". There are two discs whereon the talented if pathetic-sounding Norman Wisdom is heard in numbers from his film "One Good Turn" (P 26152 and 26155). The classical release has some desirable items. Strauss's opera "Salome" (ABL 3003-4) comes against strong competition from Decca, but it has likewise been made at the Vienna State Opera and I do not think it a disappointment. For followers of more conventional paths in opera there is a delightful record (NBR 6003) by the Netherlands Opera Chorus, who sing old timers like those from "Rigoletto" and "Trovatore", balanced by choruses equally old but much less known, from "Lombardi" and "Don Pasquale". This record definitely fills a gap and could be recommended as heartily to our middlebrow friends as to the confirmed devotees of opera. There is also interest in a collection of Strauss favourites recorded under the title of "Vienna Garden Party" on NBR 6012, and conducted by Eduard Strauss, seemingly one of the family, perhaps a descendant of Johann's younger brother Eduard, who died in 1916.

(Concluded on page 52.)

EUTRON
Elements by the Truck Load



ABOVE: The new Eutron factory in College Hill which will become the main manufacturing plant and headquarters of Mr. J. Nicholson (Eutron Nick) Managing Director of the company.



ABOVE: The original factory in Grey Lynn where production will continue of special types of elements.

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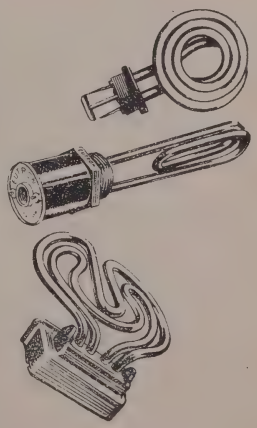
It's all happened in only nine years! From a mere handful of Jug Elements daily, the output of the now extensive Eutron organization has grown to thousands per week of not one type of element only, but to hundreds of types from two factories. The big demand from both commercial and domestic users is clear evidence of Eutron's superiority and reliability . . . proof that Eutron reflects the highest degree of technical skill and laboratory research necessary to the maintenance of standards of manufacture second-to-none! Electric Utilities can quote and deliver elements for practically any application.



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ELECTRICAL AND TRADE SECTION

FLUORESCENT FITTINGS

(Reprinted from "Electrical Industries Export", November, 1954)

The lighting of a large factory or office block with fluorescent lamps usually calls for a variety of fittings to suit the illumination requirements of the various sections. For example, administrative offices may require a more attractive fitting than often do works offices. Factory lighting requires yet another type of fitting, and in some atmospheres the finish of the fitting is an important consideration. Showrooms and the like often demand special lighting effects.

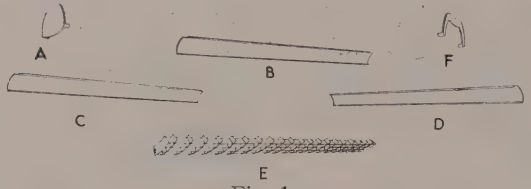


Fig. 1.

To cater for all these requirements normally calls for the purchasing and stocking of many individual types of fitting—a procedure which, besides involving considerable expense, may mean that the fittings in the various sections vary in appearance. Difficulties arise, too, when it is desired to change the function of a department or room, and with it the lighting.

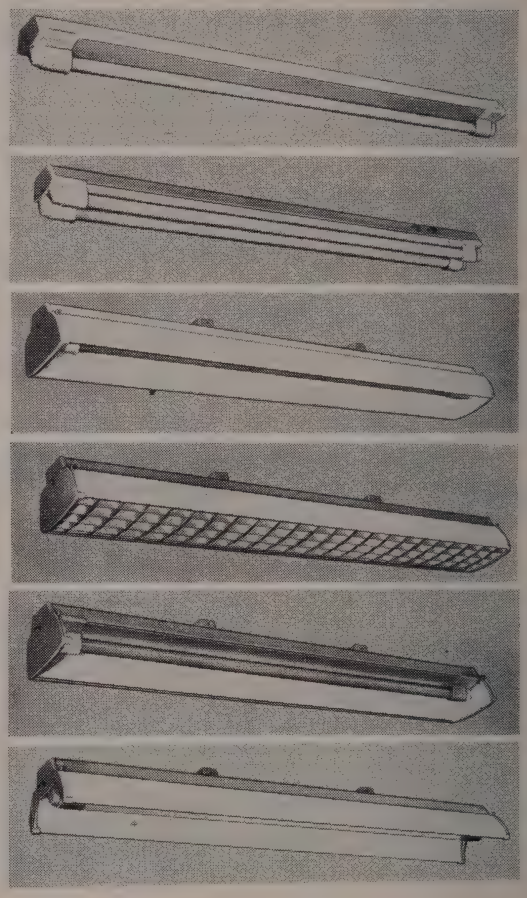
To overcome these objections, Crompton Parkinson Ltd., Crompton House, Aldwych, London, W.C.2, England, have developed what they term their "New Range" of 5-ft. fluorescent fittings, by which from but ten standard components no fewer than 54 different forms of fitting can be assembled.

Forming the foundation of the range are the one-lamp and two-lamp general lighting fittings shown in Figs. 2 and 3, which are available with base reflectors having either a "Permawhite" high-gloss stove enamel finish, or, for gritty atmospheres, a vitreous enamel finish. These fittings incorporate a number of features designed to make installation easy. They are built-in quick-fixing devices for close ceiling mounting and infinitely variable fixing centres for normal pendant mounting. Any form of wiring system and suspension can be accommodated. Spring-loaded earthed contact lampholders with sliding end shields are fitted at both ends, thus enabling lamp replacement to be carried out easily from either end of the fitting, or from the centre, without any turning action.

The visible action starters are situated on one side of the channel and are readily accessible, as are the terminal blocks for mains connection. The internal wiring is colour coded and the whole unit is constructed in accordance with B.S.2467/1954.

From these general lighting fittings, a range of reflector fittings can be built up by the addition of light alloy die-cast end plates to which side reflectors of different types, and also a louvre, can be fitted.

For closed-end fittings, the end plate A, Fig. 1, is attached by means of two screws to take either two closed-side metal reflectors B, or open-top reflectors C (where a certain amount of top lighting is required),



Figs. 2 to 7; reading from top to bottom.

or with opal diffusing perspex side reflectors D, to give the fittings illustrated generally in Fig. 4.

A feature of the open-top fitting, incidentally, is that there are no obvious apertures to cause glare, nor are there any projections to interfere with the easy cleaning of the equipment.

When a louvre fitting is required (Fig. 5), a standard rigid metal louvre (E, Fig. 1) can be attached to the two end plates without the use of screws, and equally readily removable for maintenance purposes. All the fittings can be used as single side reflectors for lighting wall charts and displays, blackboards, and the like by the simple expedient of omitting one of the side reflectors, as shown in Fig. 6.

Fig. 2.—Basic single-lamp general purpose fitting, produced with either "Permawhite" finished or vitreous enamel-finished base reflectors.

Fig. 3.—Basic two-lamp general purpose fitting—suitable for surface or pendant mounting and has wide range of applications.

Fig. 4.—A variety of closed-top reflector fittings can be built up by fixing cast and plates to the general purpose fittings and attaching the type of reflectors required.

Fig. 5.—All the closed-in fittings can be converted to louvre fittings by the simple attachment of a rigidly formed louvre.

Fig. 6.—The use of only one reflector provides a fitting that has obvious advantages for the lighting of display shelves, wall-charts, etc. Louvres may still be fitted if desired.

Fig. 7.—Where economy is of prime importance, open-ended fittings can be arranged simply by fitting a diffcrent type of end support in place of the end plates.

For installations in which low cost is of prime importance, and it is unlikely that louvre fittings will be required, the end plate shown at F, Fig. 1, can be used. All reflectors and end plates are common to the one- and two-lamp basic fittings.

In developing this range, the manufacturers made a comprehensive survey of users' needs and preferences, and a careful study of modern building construction and trends in lighting development. The services of an industrial designer, Mr. Peter Bell, M.S.I.A., were commissioned to ensure that good style and line should be obtained.

The result is a most attractive range in which the same family likeness is maintained throughout the 54 types, and which, in addition, have the features enumerated which contribute materially to the ease of installation and hence low cost.

Maintenance is easy, reflectors can be removed while the lamp is alight, and a feature of particular value is the ready manner in which fittings already installed can be modified without disturbing the basic fittings and wiring. An installation can, in fact, start with the simple general purpose fitting and be brought up to better standards when conditions are known, or permit, with the minimum cost and inconvenience.

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Elektrotehniski Vestnik, 1955, No. 1-2.
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FOR REVIEW

From John F. Rider, Publisher (Inc.), 480 Canal Street, New 13, N.Y.:
"Basic Electronics", by van Valkenburgh, Nooger & Neville, Inc. Vol. 1—Introduction to Electronics, Diode Vacuum Tubes, Dry Metal Rectifiers. What a Power Supply Is. Filters, Voltage Regulators; Vol. 2—Introduction to Amplifiers. The Triode Tube, Tetrodes and Pentodes, Audio Voltage and Power Amplifiers; Vol. 3—Video Amplifiers, R.F. Amplifiers, Oscillators; Vol. 4—Transmitters, Transmission Lines and Antennas, VW Transmission and Amplitude Modulation; Vol. 5—Receiver Antennas, Detectors and Mixers, TRF Receivers, Superheterodyne Receivers.
"How to Instal TV Antennas", by Samuel L. Marshall.
"Picture Book of TV Troubles',. Vol. 2, Vertical Sweep and Deflection Circuits, by John F. Rider Laboratories Staff.
"Rider's Specialized Tape Recorder Manual, Vol. 1."
"Basic Vacuum Tubes and Their Uses," by John F. Rider and Henry Jacobowitz.
"TV Repair Questions and Answers—Front Ends" by Sidney Platt.
"Basic Electricity", by van Valkenburgh, Nooger & Neville, Inc. Vol. 1—Where Electricity Comes From, Electricity in Action, Current Flow, Voltage Resistance, Magnetism, D.C. Meters; Vol. 2—Direct Current Circuits, Ohm's and Kirchhoff's Laws, Electric Power; Vol. 3—Alternating Current, Resistance, Inductance, Capacitance in A.C., Reactance, A.C. Meters; Vol. 4—Impedance, Alternating Current Circuits, Series and Parallel Resonance, Transformers; Vol. 5—D.C. Generators and Motors, Alternators and A.C. Motors, Power Control Devices.
From Iliffe & Sons Ltd., Dorset House, Stamford Street, London, S.E.1.
B.B.C. Engineering Training Manual: "Studio Engineering for Sound Broadcasting", by members of the Engineering Division, British Broadcasting Corporation—General Editor, J. W. Godfrey.

BACK NUMBERS OF "R. & E. R."

Back numbers are available from:

S.O.S. Radio Ltd., 283, Queen Street, Auckland.

S.O.S. Radio Ltd., 1 Ward Street, Hamilton.

Webb's Radios Ltd., 11 Wellesley St. E., Auckland.

Tricity House Ltd., 209 Manchester St., Christchurch.

Ken's Ltd., 142-144 Stuart Street, Dunedin.

Fear's Radio and Cycle Co. Ltd., 31 Willis Street, Wellington.

The Radio Service Co., 83 Guyton Street, Wanganui.

Technical Book and Magazine Co., 295-299 Swanson Street, Melbourne, Australia.

NEW PRODUCTS: LATEST RELEASES IN ELECTRICAL AND ELECTRONIC EQUIPMENT

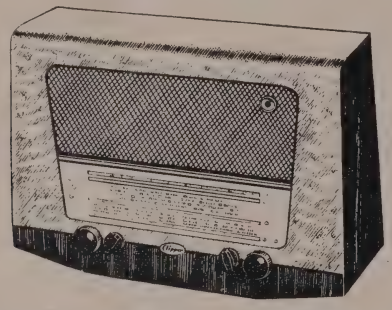
This section of our paper is reserved for the introduction of new products and space preference is given to our regular advertisers. For further particulars contact Advertising Manager, R. & E., Box 8022, Wellington.

CLIPPER NEWCOMERS

Three new Clipper models are to be introduced to the New Zealand market in July. The three newcomers, Models R24, R28, and 965, are attractively designed mantel models that follow the tradition already established by earlier Clipper models; they combine contemporary good looks, a high degree of workmanship and popular prices.

Clipper Model R24

In the R24, Clipper have produced a radio deserving of the highest praise. The up-to-the-minute cabinet design is a marked advance on the present trend, while great care has evidently been taken to avoid offending the more conservative customer with a model too bizarre in appearance.



Inside, the R24 lives up well to its outside appearance. The same high quality of design is evident, and there are many features that will make this model one of today's most popular radios. Briefly, the Clipper R24 is a six-valve (including magic eye) world-wave mantel model; its most noteworthy feature is ease of tuning brought about by the combination of bandspreading, magic- eye, and Clippermatic flywheel tuning control.

Returning to the cabinet, the dimensions of which are 19⅞ in. long x 14¼ in. high x 7¼ in. deep, this is finished in a most attractive combination of highly polished walnut and bird's-eye maple with a pleasantly patterned fabric grille.

Retail price, £3 7s. 6d.

Clipper Model R28

This five-valve all-wave mantel, retailing at only £28 10s., boasts a quality of reception not to be equalled by many of its bigger brothers. Clippermatic flywheel tuning and bandspreading also take the R28 well above its class in today's market.

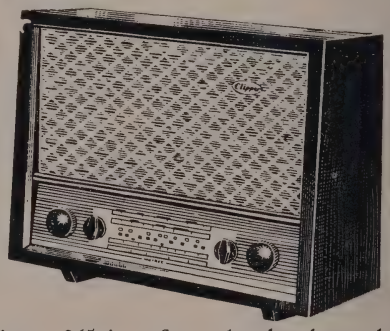
The cabinet, while being more conservative than the R24, is equally easy on the eye, and possesses the big advantage to many of easy portability. Dimensions: 16 in. long x 9 in. high x 6¾ in. deep.

Once again a very pleasing finish is achieved by the use of contrasting veneers in light and dark walnut.

Retail price, £37 7s. 6d.

Clipper Model 965

In the publicity material issued in conjunction with the 965, this model is justly described as "another Clipper triumph." A triumph in cabinet design, which is conventional without being "ordinary," a triumph in workmanship, which gives quite exceptional performance; and last, but far from least, triumph in price—£33 7s. retail.



The Clipper 965 is a five-valve bandspread mantel model capable of round-the-world reception.

Distinguished in appearance, the cabinet is finished in highly polished walnut veneer, and measures 17½ in. long x 16 in. high x 12½ in. deep—a full-sized mantel model to grace any home.

All in all, the 965 could well become tomorrow's best-selling mantel radio.

Clipper radios and radiograms are manufactured in New Zealand by the Akrad Radio Corporation Ltd., Waihi, and are distributed solely by G. A. Wooller & Co. Ltd., Box 2167, Auckland, and branches at 43 Lower Taranaki Street, Wellington, and 16-18 Victoria Street, Christchurch.

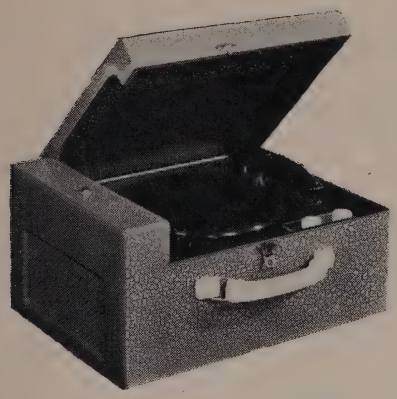
* * * *

ULTIMATE GRAMOPHONE-AMPLIFIER

A new versatile gramophone-amplifier has just been released by Radio (1936) Ltd.

The amplifier section uses 1 x UL41, 1 x UL42, and an RM1A rectifier, and is designed to give two watts output. The speaker used is a Rola 6H.

The gramophone unit is a Collaro three-speed player with interchangeable plug-in heads. The whole unit is housed in a crackle-finished cabinet, the interior of which is flock sprayed. The volume



and tone controls are mounted on the motor panel, and a power indicator is mounted on the outside of the cabinet to give positive indication that the equipment is drawing power. Rubber feet protect the cabinet as well as furniture in both the carrying and playing positions of the gramophone-amplifier.

Fitted with a comfortable carrying handle, the Ultimate Gramophone-Amplifier is easily portable and designed to give years of reliable service.

Specifications:

Tubes: 1 UL41, 1 UL42, 1 RM1A.
Speaker: Rola 6H.

Measurements: 18½ in x 13¾ in. x 9¼ in.
Weight: 21 lb.

Retail price: £28 12s. 6d.

* * * *

G.E.C. ULTRA-LINEAR OUTPUT TRANSFORMER

The G.E.C. Ultra-linear Output Transformer is a high-quality component manufactured by Collier & Beale Ltd. It is conservatively rated at 12 watts. The primary is wound for 7,000 ohms, anode to anode with 20 per cent. taps for connection to the screens. The secondary is wound for 1.875, 3.75, and 15 ohms. The transformer, whilst primarily designed for the Osram 912, is ideally suited to amplifiers using KT66 valves in ultra-linear operation provided the maximum power is restricted to 12/15 watts. For above-chassis mounting, the transformer is fitted with cadmium-plated shrouds. (See Editor's article on ultra-linear operation in April issue of "Radio and Electrical Review.") Price, £7 4s. From dealers and branches of the British General Electric Co. Ltd.

THE OSRAM B309

The Osram B309 is a double triode with independent cathodes, ideally suited for early push-pull stages. It is of robust design and free of microphony in normal applications. Price, 17s. From dealers and branches of the British General Electric Co. Ltd.

THE OSRAM LOW-NOISE PENTODE Z729

The Osram Low-noise Pentode Z729 is claimed to be the finest low-noise valve available. This noval-base, all-glass valve has been designed for use in audio frequency circuits demanding the utmost freedom from hum, microphony, and other undesirable effects. Special precautions have been taken to reduce to a minimum the capacitance between control grid and heater. The construction of the Z729 will normally prevent acoustic feedback; consequently no precautions are required to overcome microphony. Internal screening obviates the necessity for an external can. Price, 16s. 3d. From dealers and branches of the British General Electric Co. Ltd.

THE OSRAM 912 BOOK

The "Osram 912" book is of interest to those who have already read "Art and Science in Sound Reproduction." It presents in practical form the design of the Osram 912—nine octaves response, twelve watts audio output—a completely up-to-date and economical reproducer of gramophone recordings and describes how the home constructor can build this high-quality equipment for which all the parts are available locally. Price of the book, 4s. 6d. Available from dealers and branches of the British General Electric Co. Ltd.

B.G.E. NEW LIGHTWEIGHT ELECTRIC IRON

The British General Electric Co. Ltd. has introduced a new electric iron which is much easier to handle than most conventional household irons owing to its light weight and carefully balanced design. Modern fabrics don't need a heavy iron, and it is the quickly and evenly distributed heat of this iron that ensures perfect ironing. The heating element is embedded in the lightweight soleplate, and will give many years of valuable service. The thermostatic control acts instantaneously, preventing interference with radio reception.

Despite its light weight, solidity of construction has been achieved, and these features, as well as the agreeable appearance, make this iron an attractive commodity. It is covered by a 12 months' guarantee, and the retail price is £4 10s.

TIME SWITCHES
FOR SALE

Time Switches removed from service and in working order, but being sold without warranty. All are electrically wound 230-volt, and most are Venner make.

Price £3, each.

TARARUA ELECTRIC POWER BOARD
P.O. Box 16, PAHIATUA.

CLASSIFIED ADVERTISEMENTS

Rates 4d. per word, minimum charge 3s. Deadline date 1st of month preceding publication.

When there's a better switch
ARCOLECTRIC ***will make it***
New Zealand Agents
GREEN & COOPER LTD. WELLINGTON.

N.Z. Radio Traders' Federation Conference, 1955

Held at Nelson from 21st to 23rd May inclusive, the Conference of the New Zealand Radio Traders' Federation was an outstanding success.

Hosts were members of the Nelson Association, who treated their guests royally, even if the traffic authorities were rather lavish with their little blue notices! Saturday was devoted to arrivals and settling in—a time for convivial getting together—while on Sunday the beauties of the district were unfolded to delegates during a series of bus and motor tours. Highlight of the morning was a trial of strength, known as "The Boat Race", between Les Hepburn and A. K. Griffiths, with the final honours going to Canterbury (Hepburn). Needless to say, both winner and loser celebrated the occasion appropriately!

Officially opened by the Mayor of Nelson on Monday morning, the Conference lost no time in settling down to business, the chair being very ably occupied by Mr. Les Hepburn, vice-president, in the absence of the president, Mr. Noel Souper, due to illness.

Details from the President's Annual Report were published on pages 44 and 53 of the June issue of "Radio and Electrical Review".

The following is a brief summary of some of the major items discussed at the Conference.

Publicity:

Conference learned of the methods adopted by the Taranaki Association to solicit trade for members of the Association by the insertion of a series of advertisements in local papers recommending the public to purchase from members of the Taranaki Radio Traders' Association, and featuring the seal of the Association, which was prominently displayed in the windows of all members. Such action had resulted in the enlisting of a considerable number of new members, and it was recommended that other Associations might consider similar endeavours to improve their membership. It was finally resolved that copies of the advertisements used by the Taranaki Association should be forwarded to all associations, and that the executive should consider the advisability of having similar advertisements inserted in the "New Zealand Listener".

Register of Bona Fide Radio Dealers:

Owing to the lack of interest shown by members in the bona fide Radio Dealers' Register, the chairman questioned whether the cost of production was warranted, and suggested that it was up to members to make this register a success.

Radio Interference:

Mr. G. K. Milne, Deputy Engineer in Chief, Post and Telegraph Department, who made a special journey to Nelson to address the Conference, gave an encouraging account of action being taken to combat this nuisance.

He considered that the standing committee performed a useful purpose in that it provided the means whereby the various interests could discuss the problem. In future, meetings of the interference committee will be held at six-monthly intervals. Though this may seem a little infrequent, it gives committee members time to consult with their respective organizations. The committee is also investigating existing legislation with a view to suggesting amendments to permit stronger action and ensure that noise suppression is more adequately implemented.

A practical brochure is to be distributed to listeners when they renew their licences. This deals with aerial systems, sources of interference and the means of minimising them. It also provides a form on which a sufferer from interference can log some data which will assist the Post and Telegraph Department when it has to locate the source of the interference.

Mr. Milne gave a list of the various causes of interference reported to the Post and Telegraph Department, and advised that in each instance the cause of the trouble had been overcome. Substantial reduction in interference from tram cars has been effected by making modifications to the contact between pole and overhead wire. As compared with the rotating wheel, the new shoe is relatively free from interference.

The number of Post and Telegraph Department inspectors on the road has been increased, and this, coupled with new interference measuring equipments, materially assists location of the point of interference and measuring it at its source.

Mr. Milne requested traders, when selling receivers, to stress the benefit of a good aerial and earth system, for all too frequently, the public is left with the impression that the two feet of wire protruding from the set is sufficient. Even though the erection of an aerial is laborious, the results are well worthwhile. A rod aerial is simple to install and it results in greatly improved reception. He suggested that traders should also ensure that, where they are likely to cause trouble, all electrical appliances sold should be fitted with suitable suppressors.

In his report, read by the chairman, Mr. Billing, Federation representative on the interference committee, stated that his work would be greatly assisted if associations would advise him of complaints which he could place before the committee. The Conference unanimously passed a vote of thanks to Mr. Billing for his sterling work, and reappointed him Federation representative on the interference committee for the ensuing year.

In view of Mr. Milne's address and Mr. Billing's report, the Taranaki remit (see page 44 of June "R. & E.") was withdrawn and Conference resolved that the Federation extend to the standing committee its thanks for the work done. It pledged the Federation's support in any action which the committee might take to eliminate interference, with the hope that, now that regular meetings of the committee are being held, future results would justify the increased activity.

Stabilization of Voltages:

Following a discussion concerning the variations in voltage (190 to over 260 volts) Conference passed unanimously the Wellington remit (page 44 of June "R. & E.") "that the New Zealand Radio Traders' Federation be requested to approach all power boards asking them to stabilize their voltages at the standard rate for New Zealand, namely 230v., as it appears that in many cases, the public are receiving either a greater or lesser voltage, to the detriment of electrical appliances which are manufactured for 230 volts." The secretary was instructed to write to the Supply Authorities' Association asking it to endeavour to stabilize power supply at the New Zealand standard of 230v.

Power Board Trading:

Mr. B. C. Barwick, the Wanganui delegate, outlined the problem experienced in his area through the aggressive trading policy of the Wanganui/Rangitikei Power Board. Though, so far, only appliances were affected, it was reported that radios had been offered by three manufacturers. This Board's turnover had now reached £121,000, and nett profit amounted to £16,334. Unlike a normal trader, its **profit is not subject to income tax.** Furthermore, apart from the taxation angle, any power board has advantages denied the normal trader. Through its monthly accounts it is in constant contact with electrical consumers, and can collect bad debts through refusal to supply power. As far as extended payments are concerned, finance presents no obstacle. A power board is the first to know of any new reticulation. Because of its size it is in a better position to arrange for exclusive agencies than a small trader, and it has the right to grant or refuse permits for new installations and determine the standards which are to apply.

All were agreed that competition is the life of trade, but that unfair competition can wreak havoc, and it was considered that power boards should devote their energies to the matter of power supply on which they already enjoy a monopoly, leaving merchandising to the traders. This issue is a serious matter for the electrical traders, for they cannot meet with the competition from boards with the strength and financial resources of a local body and enjoying the privilege of exemption from income tax.

Conference delegates were unanimous in their decision to send the following telegram to the Minister in Charge of the State Hydro-Electric Department:

> "Members of the New Zealand Radio Traders' Federation at their annual Conference viewed with concern the serious inroads being made into the normal trading business of private electrical appliance dealers by Power Supply Authorities. It is considered that the wide powers vested in supply authorities to use public finance to trade in opposition to retailers is becoming a real threat to private enterprise."

It was also resolved that the New Zealand Radio Traders' Federation should endeavour to enlist the active support of the Retailers' Association, the Manufacturers' Association and the New Zealand Electrical Federation, with the object of presenting a united case to the Government for the introduction of legislation to restrict power board trading.

Board of Trade Enquiry—Electric Batteries:

It was decided to take no action with regard to the forthcoming hearing.

Margins on Small Sets:

During the considerable discussion on this subject, the Auckland representatives announced that, in their association's discussions with manufacturers, already some measure of agreement towards the goal of 50 per cent. mark-up cost, including sales tax, on all sets had been secured. Various speakers emphasised the high

(Concluded on page 49)

LATEST OVERSEAS DEVELOPMENTS

NEW RCA PICK-UP TUBE FOR COLOUR TV CAMERAS GENERATES ALL COLOUR SIGNALS SIMULTANEOUSLY

Developmental Tricolor Vidicon, Seen as Major Step Toward Colour TV Cameras, Described by RCA Scientists in Progress Report to IRE.

It was disclosed at the annual convention of the Institute of Radio Egineers of America, that a revolutionary new type of colour television camera tube which generates simultaneously the red, green and blue signals of colour TV is under development and has been successfully tested by scientists and engineers of the Radio Corporation of America.

According to R.C.A. scientists, the developmental tube, known as the Tricolor Vidicon, represents a major step in a continuing research program aimed at achieving an all-purpose color television camera as simple and compact as those now used for black-and-white TV. In tests in a modified black-and-white camera at the David Sarnoff Research Centre of R.C.A., Princeton, N.J., it has shown the ability to televise colour slides, colour motion pictures, and scenes where high levels of lighting may be used. Further development is expected to achieve greater sensitivity, making the tube suitable for use under varied lighting conditions.

Details of the new tube were given in a progress report to the I.R.E. by a five-man team of R.C.A. scientists headed by Dr. Paul K. Weimer. The group includes Dr. Sidney Gray, Dr. Stefan A. Ochs, Harold Borkan, and Harry C. Thompson.

It was pointed out by the group that a single camera tube capable of generating simultaneously all three of the primary colours of colour TV is a major goal of television research. In present colour TV cameras, they explained, a separate tube is used to pick up each colour, and the three independent signals are later combined into a composite signal for broadcast.

ADVANTAGES OF THE DEVELOPMENTAL TUBE

Dr. Weimer, delivering the paper for the research team, pointed out that the developmental Tricolor Vidicon combines all of the colour pickup functions for the first time in a single tube no larger than the standard R.C.A. Image Orthicon tube used in black-and-white cameras. Since all of the colour signals are generated simultaneously in the same tube, he said, precise optical and electrical registry is ensured, thus avoiding any danger of overlapping or "fringing" of colour signals. In addition, he said, use of a single tube will permit greater simplicity and compactness in colour camera design.

The research team gave this explanation of the operating principles involved in the Tricolor Vidicon.

The heart of the tube is a unique and intricate colour-sensitive target applied to the face of the tube by an evaporation technique. The target, a rectangle whose diagonal measurement is only 1½ inches, consists of nearly 900 fine vertical strips of alternating red, green and blue colour filters, covered by three sets of semi-transparent conducting signal strips spaced so closely that a group of several strips would be covered by the diameter of a human hair. The signal strips corresponding to a given colour are all connected to a common output terminal, and insulated at the same time from the strips of the other two colours.

THREE COLOUR SIGNALS ARE GENERATED

As the target is scanned by a single electron beam projected from the rear of the tube, the colour-sensitive filters permit the signal strips to produce electrical signals corresponding to arrangement of light and colour in the scene before the camera.

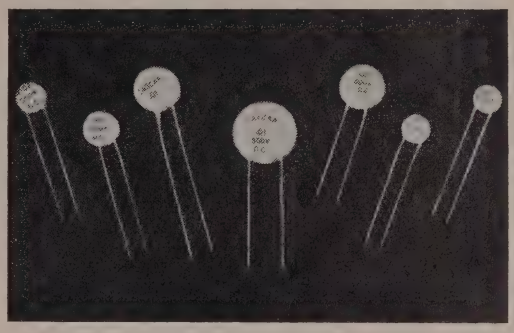
The beam, sweeping horizontally across the face and moving in lines that progress from top to bottom of the target—as in present camera tubes—scans the face completely thirty times each second. As the beam strikes all of the colour-sensitive strips at each scanning, the tube generates directly the three simultaneous primary colour signals required to form the composite signal for broadcast.

Current research the R.C.A. team said, is concentrating on the development of more sensitive photoconductive materials that will permit a tube of this new type to operate as efficiently under all lighting conditions as present studio-type camera tubes.

CASCAP CERAMIC CAPACITORS

A new range of inexpensive ceramic capacitors, known as "Cascaps", has been introduced by Plessey.

The material used is of the barium titanate type, having high permittivity and dielectric strength, enabling miniature capacitors to be produced, for operating at high voltages over a wide temperature range and used in applications where precision of capacitance is not of primary importance.



"Cascaps" are available in two basic types, one for purposes such as R.F. decoupling and the other for radio interference suppressors. By varying the composition of the ceramic, the capacitors can also be made suitable for special applications.

The normal types are constructed in capacitances ranging from 0.0005 to 0.01 mfd., 500V D.C. or 300V A.C. working with a breakdown voltage of 4,000V D.C. and an insulation resistance of 1011 ohms. With these excellent electrical characteristics, a 0.005 mfd. capacitor measures only 0.664 in. in diameter and is 0.187 in. thick.

Since the miniature capacitors required in radio interference suppressors rated at 230V A.C. Class Y are required by BSS. 613 to have a breakdown voltage of 2760V A.C. or D.C., a special range of "Cascaps" has been developed with capacitances of 0.0005, 0.005 and 0.01 mfd., to meet the requirements of Class X and of 0.0005 and 0.005 for Class Y. These are little larger than the normal "Cascaps", the diameter and thickness of a 0.005 mfd. Class Y capacitor being 0.898 in. and 0.135 in. respectively.

All "Cascap" capacitors are now finished in a recently developed paint coating, which forms a thick protective layer on the disc and provides additional mechanical strength. This coating has exceptionally high insulation resistance, while it also prevents entry of moisture, so avoiding the necessity for wax impregnation.

The special coating is hard and smooth and green in colour. It has a high abrasion resistance, while the thickness of the coating also tends to minimize damage due to accidental contact with soldering irons.

These units have been subjected to the 28 days tropical exposure requirements of the draft BSS. 613 specification for suppressor capacitors and to the 86 days tropical exposure test of R.C.S. 11, classification H.1. Deterioration of the coating as a result of these tests is insignificant and the insulation resistance remains high.

THE AUTO-LITE "STA-FUL" BATTERY

For some years Auto-Lite has plugged the slogan that its Sta-Ful battery "Needs Water Only Three Times a Year in Normal Car Use." The slogan was based on extensive laboratory tests conducted at the time the Sta-Ful was perfected.

Two years ago the company undertook a closely supervised field test, unique in the industry, on 100 Sta-Ful batteries in the cars of average drivers in nine widely scattered American cities. The batteries were picked from production lines, and except for the usual factory inspections were not given special tests before installation.

After a total of nearly one million miles of driving, during which not one of the batteries failed, the final results showed that Auto-Lite would be justified to claim its Sta-Ful battery needs water only twice a year in normal car use. In fact, 25 per cent. of the batteries tested had water added only once during the two years.

TRADE WINDS

AUCKLAND RADIO MANUFACTURING GROUP ENTERTAINED AT NEW DRECO FACTORY

From left to right: C. A. Pearson (Dreco), T. R. Gobby (Dreco), D. T. Clifton-Lewis (Radio 1936), R. W. Cox (Dreco), R. J. Orbell (Radio 1936), T. F. J. Spencer (Akrad), R. Walker (Autocrat), W. J. Meighan (Sheffield), D. Black (Westco), A. Bell (Bell), W. Murphy (Radio 1936).

A most enjoyable evening was spent recently at the new DRECO factory, when members of the local Radio Manufacturing Group were entertained.

Following refreshments, an inspection was made of the plant, and all present were most impressed by the building and lay-out. Most complimentary references were made about the design and appearance of the factory, while the staff facilities and working conditions created much interest. In a typical lively speech, Mr. D. T. Clifton-Lewis extended the Group's good wishes and congratulations. Mr. T. R. Gobby, in replying, stated that the new Philco plant created a challenge to many existing manufacturers. He emphasized that suitable premises, good lay-out, and proper worker facilities were becoming most essential factors in product quality and manufacturing efficiency.

In addition to the beneficial effect on the companies concerned, the growth of new plants, he stated, will do much to raise the level of the industry and prepare it for the vigorous times ahead.

The most friendly spirit existing at the function was typical of the cordial relationships enjoyed by local manufacturers and speaks well for the standard of the Auckland Group.

* * * *

NEECO GIVES HIGHLY SUCCESSFUL COOKING DEMONSTRATION

Last month, at the Demonstration Hall of the Hutt Valley Electric Power Board's impressive new premises in Lower Hutt, a cooking demonstration was presented by the well-known overseas caterer, Mr. D. G. H. Thwaits.

Before a highly critical audience of some 150 women, Mr. Thwaits presented a luncheon, afternoon

tea, and five-course dinner for six persons on consecutive afternoons using Neeco Consort electric ranges.

Each programme occupied about 1½ hours, and audiences were given either coffee or tea before the demonstration commenced and provided with some excellent cakes specially baked for the occasion.

Mr. Thwaits, besides being an excellent chef, delivered his demonstration lectures with a touch of humour that was greatly appreciated by his audiences.

The three-day demonstration was presented by the National Electrical and Engineering Co. Ltd., makers of the Neeco range, and by courtesy of the Hutt Valley Electric Power Board.

* * *

NEW WELLINGTON PREMISES FOR AMALGAMATED WIRELESS (AUSTRALASIA) LTD.

Always in the van of progress, Messrs. Amalgamated Wireless (Australasia) Ltd. have just moved their offices and showroom to Wellington's newest building, Anvil House, in Wakefield Street. Clients are invited to visit A.W.A. and inspect its new showroom, where equipment on display includes, besides the normal range of A.W.A. products, Marconi X-ray and electro-medical equipment, Schonander X-ray apparatus, Keleket X-ray equipment, Stanley Cox physiotherapy equipment, Telcon cables, R.C.A. and A.W.V. valves, Welwyn resistors, T.M.C. telephone equipment, Turner meters, and Kelvin & Hughes echo-sounders and industrial equipment.

The warehouse and workshop remain on the lower floor of J. J. Curtis Building, Johnston Street, Wellington.

The telephone number of the new office is 45-076 and the Post Office box number is 830.

We extend our heartiest congratulations to A.W.A. on the acquisition of these fine new premises.

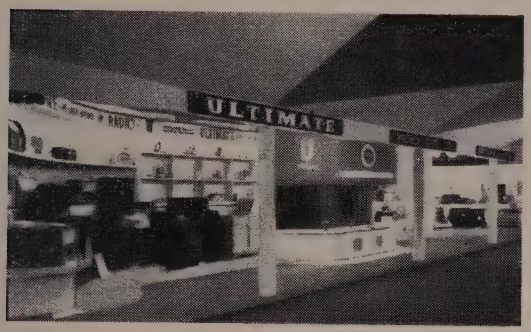
* * *

NEW "ROLA" DISTRIBUTORS

As from 1st July, 1955, Arnold & Wright Ltd. have been appointed sole New Zealand distributors for "Rola" loudspeakers and transformers.

Messrs. Arnold & Wright, with branches in Auckland, Wellington, Christchurch, and Dunedin, will welcome inquiries from all dealers.

RADIO (1936) LIMITED STARS AT THE EASTER SHOW, 1955



At the Auckland Easter Show, held in April last, Radio (1936) Limited occupied one of the largest stalls in the manufacturers' pavilion and enjoyed a most successful season. As manufacturers, the company has little contact with the public generally, and it was pleasant to find how highly regarded are Ultimate products. Many spontaneous expressions of approval and appreciation were received, and it was gratifying to note that the consumer-manufacturer relationship remains at the highest level.

Forty-eight feet long and making full use of colour, both in paint and in lighting, the attractive stall formed a fine setting for the representative range of radio and electrical goods displayed. New products, in both radio and electrical lines, aroused great interest, particularly the display of ECKO goods which showed the shape of things to come.

Great interest was shown in goods that were displayed for the first time in New Zealand, and in addition to the EKCO products, these included a continental infra-red electric barbecue griller, the Freshette vegetable freshener, the Moderncom intercommunications systems, and the Ultimate ultralinear amplifier and pre-amplifier.

Animation was provided by marionettes, and these lovable characters held the interest of the public, adults and children, from the first to the last. Shows which incorporated singing and dancing as well as demonstrations of Ultimate products were given hourly, and the general opinion of the public was that the "puppets" were one of the topmost attractions of the entire show.

Many thousands of booklets explaining and publicizing Ultimate products found their way into the homes of the public. "Give away" sessions were conducted from the stall, when Ultimate electrical products were valued prizes. At two "Posers, Penalties, and Profits" sessions, Ultimate lowboy radio-grams were the highlight prizes, and one of them was won by a man with seven children. It was an interesting coincidence that this man's first job in life was with Radio (1936) Limited.

Altogether, a successful show confirming that no one ever regretted buying quality.

BINDERS FOR "R. & E."

These are available to hold 12 issues—price 5s. 6d.

Mr. George Ferris

Radio (1936) Limited's representative for Canterbury, Westland, Marlborough, and Nelson. He attended the sales conference held by Radio (1936) Limited in Auckland recently.

* * *

ANNUAL CONFERENCE OF N.Z. RADIO-TELEVISION AND ELECTRICAL TRADERS' ASSOCIATION (Inc.)

The New Zealand Radio-Television and Electrical Traders' Association (Inc.) announces that its annual meeting and conference of members will take place at Waitomo Hostel from Friday, 26th to Sunday, 28th August.

Last year more than 60 members attended the most successful conference at Cambridge, and the Associations extends a hearty invitation to all radio dealers to attend its Waitomo Conference.

* * * *

APPOINTMENT FOR Mr. J. W. RAMSDEN

Mr. J. W. (Jack) Ramsden, a well-known figure in the radio and electrical industry, has been appointed Sales Manager of the Frigidaire Division of General Motors (N.Z.) Ltd.

In recent years, Jack has been prominent in the marketing of Philco radio, Morphy Richards electrical appliances, etc., throughout the Dominion.

He became interested in the industry as a young man, and has been connected with it ever since. As a matter of interest, his amateur operator's certificate is dated 1929; Jack has therefore seen many changes in the radio and electrical field.

During the war, he enlisted with the army and then transferred to the R.N.Z.A.F., where he was put

on radar work. On arrival in the United Kingdom, however, he transferred to air crew. He completed a tour of operations with Coastal Command and then a tour on Transport Command, gaining commissioned rank, and travelled extensively in Europe, Africa, and Asia.

Marrying an Oxford girl, Jack worked in London after demobilization. He was with a large manufacturer of radio and television, Sobell Industries Ltd.

He joined Russell Import Co. Ltd., a subsidiary of the Chas. Begg organization, in 1948, and was the company's representative in the Wellington territory until his transfer to the post of South Island representative. In 1951 he was promoted to sales manager, the position he leaves to join General Motors.

Jack has made a host of friends in the wholesale and retail trades all over the country. He looks forward to renewing these friendships and doing further business with many of these friends in his new post.

* * *

DEMONSTRATION OF INDUSTRIAL TELEVISION AT OTAHUHU BREWERY

"Favourable consideration is being given to a proposal to install television at Dominion Breweries Ltd.," stated Mr. H. J. Kelliher, Managing Director, after viewing a demonstration of industrial television given by Pye (New Zealand) Ltd. at the Otahuhu brewery on 2nd June.

"The process," he said, "has novelty value, advertising possibilities, and no doubt other advantages for industry when television had passed the experimental stage in this country." It could be of absorbing interest to people wanting to see over the brewery, and he visualized the possibility of their being able to sit in the firm's premises in the city and watch in comfort the processing of beer at the brewery 10 miles away. By means of television, it would be possible also to demonstrate the processing in about 20 minutes, compared with the two or three hours which it now takes to conduct visitors over the plant.

About a dozen directors and officials of the company watched the bottle-capping machine operating. The screen was erected in one room and the camera was focused on the plant in another part of the building close by.

* * *

RUSSELL IMPORT CO. LTD.

Succeeding Mr. J. Ramsden as Sales Manager for Russell Import Co. Ltd., is Mr. Peter Proctor, who, for the past three years has been the R.I.C. South Island Field Representative. Though domiciled now in Wellington, he hopes to maintain the associations already made and at the same time make new friends in the North Island.

Mr. Dudley Huston, who has been operating the Christchurch Depot, has taken over the territory previously covered by Peter Procter. O.I.C. of the Christchurch Depot is Mr. D. E. H. Powell.

BIRTH—To the Staff of Radio (1936) Ltd., a Bonny New Club

On 27th April, 1955, the "15 Year and Over Club" was born, and already it is a thriving new addition. The object of the club is to keep together a fine band of loyal servants who have seen 15 years' service or more with Radio (1936) Limited. Individual members have to their credit periods of service ranging from 15 years to 33 years, and the aggregate of service rendered by the club's 44 members is no less than 880 years.

The idea which led to the formation of the club belongs to Mr. M. R. D. Hamilton (known far and wide as "Mac"), and it is a source of pride that the club was suggested and formed by the staff and will be run by the staff. In the club, all are equal, and industrial rank counts little.

The first officers are: President, Mr. W. J. Truscott; chairman, Mr. M. Hamilton; secretary, Mr. C. L. Lovell; treasurer, Mr. W. V. Curtis.

The stories of the early days of radio (which is almost another way of saying the early days of Radio (1936) Limited) are legion. Many of them have improved with keeping, and will contribute to the enjoyment of the members when they meet socially.

Each member has been issued with a disc, which must be carried on the person at all times, and failure to produce it when challenged leads to a fine per challenging member. At the rate the chairman, the assistant manager, and a few others are contributing, the first social gathering should be on a grand scale!

* * *

VISIT OF Mr. H. G. NELSON, DEPUTY MANAGING DIRECTOR OF THE ENGLISH ELECTRIC CO. LTD.

With a very full programme ahead of him, Mr. H. G. Nelson, M.A.(Cantab.), M.Inst.C.E., M.I.Mech.E., M.I.E.E., Deputy Managing Director of the English Electric Co. Ltd., arrived in New Zealand at the end of June, in the course of a world tour embracing "English Electric" interests.

A son of Sir George H. Nelson, Bart., Chairman and Managing Director of the English Electric Co. Ltd., Mr. Henry George Nelson was born in 1917 and educated at Oundle School and Cambridge University. After winning an exhibition at King's College and graduating in electrical and mechanical sciences, he served his apprenticeship at engineering works in Paris, Winterthur, and Baden.

He joined the English Electric Company in 1939 as a superintendent at its Preston Works, becoming Deputy Works Manager in 1941. In 1942 he was appointed Managing Director of D. Napier and Son Ltd., a member of the English Electric group, and also a director of the parent company. In November, 1949, he became Deputy Managing Director of the English Electric Company Ltd., and since 1946 he has been an executive director of Marconi's Wireless Telegraph Company Limited, another English Elec-

tric subsidiary. He holds a number of directorships of other subsidiary and associated companies, besides being Chairman of the International Electrical Association, Member of the Nuclear Energy Panel of the Institution of Mechanical Engineers, and the B.E.A.M.A. Representative on the British National Committee of the World Power Conference.

From 1947 to 1949 he was outside lecturer in Cambridge University's mechanical science tripos course on industrial management.

This is Mr. Nelson's first visit to New Zealand, and during his busy fortnight in this country he will meet directors and staffs of the English Electric Company's New Zealand representatives (Cory-Wright & Salmon Ltd.) to discuss and advise on all aspects of English Electric activities and interests here.

An extensive travelling programme has been arranged for Mr. Nelson to give him as comprehensive a picture as possible of actual and prospective developments in New Zealand's industry, and he will meet representatives of the Dominion's Government and local body administration. Naturally, he will also seize the opportunity to view some representative English Electric jobs, particularly those connected with railway electrification and hydro-electric development.

LETTER TO THE EDITOR

Sir.—I should like to draw your attention to a statement made in the "News from Government Departments" section of the April, 1955, issue of your magazine, where the subject of V.H.F. for air traffic control is under discussion. In a list of the advantages of V.H.F. over H.F., the following appears: "The lighter airborne equipment required for V.H.F. communication is also an important consideration."

Having been somewhat intimately concerned with the problem of aircraft communication for some years, I can assure you there is no basis for this belief unless it is based on a comparison of pre-war H.F. equipment with post-war V.H.F. equipment. Power for power, currently available H.F. and V.H.F. equipment are about on a parity for weight, as exemplified by a comparison of the Marconi AD97-108 installation with the STR-12-C installation. This is largely because the bulk of the weight is determined by the power supplies, modulators, racks, and control boxes, etc., in both cases. Theoretically, the advantage lies with the H.F. equipment because of the much simpler circuitry required in connection with the H.F. section, a fact which was brought home very clearly recently in connection with the design of an equipment for a sailplane glider where minimal weight is an important consideration.

If it is argued that, power for power, the advantage is with V.H.F., then it must be admitted that such is the case only because of the poor aerial efficiency achieved in many cases on H.F. When suitable aerials are employed, the power exchanged between a pair of H.F. aerials is considerably in excess of that exchanged between a pair of V.H.F. equipments at any given distance, when equal powers are radiated in each case.—I am, etc.,

PHILIP HOWELL.

* * *

RADIO MARINE ASSOCIATED COMPANIES

International Conference at Torquay

Last May, Torquay was the venue of the Sixteenth Conference of the Royal Marine Associated Companies (R.A.M.A.C.). Delegates representing marine radio operating companies from many different countries discussed how best the service of wireless to the world's shipping could be improved by co-operation between the member companies.

It is customary for each of the twenty-four member companies in turn to act as host to the Conference, and on this occasion the host company was Amalgamated Wireless (Australasia) Ltd., whose managing director, Mr. Lionel A. Hooke, travelled to Britain for this purpose.

R.A.M.A.C. aims to maintain a high standard of marine radio equipment by co-ordinating technical research and design among its members. Information regarding progress is freely exchanged, and the association, by pooling the establishment resources of the member companies, provides radio service facilities at more than 200 of the world's seaports.

Chairman of the Conference was Mr. H. C. Van de Velde, deputy to the managing director of the Marconi International Marine Communication Co. Ltd.

"R & E" TECHNICAL PHOTOGRAPHS

Copies of original designs produced in our laboratory and featured in these pages are available. Prices are: Size 6 in. x 4 in. 3s. 6d.; 8 x 6, 4s. 6d.; 10 x 8, 5s. 6d. Please remit cash with order to Radio and Electronics (N.Z.) Ltd., P.O. Box 8022, Wellington.

CLASSIFIED ADVERTISEMENTS

FOR SALE.—Unused G.E.C. 8 in. Metal Cone High-Fidelity Speaker, £6 10s. Roots, c/o "Radio and Electrical Review."

FOR THE SERVICEMAN

H.M.V. HEAT-CONTROLLED IRON: No. 1

TECHNICAL DESCRIPTION

The construction of the iron will be seen clearly from Fig. 1 (cut-away view of iron). The cast sole plate, to which is screwed the bi-metal strip, has also three tapped holes for the screws securing the element clamp. The asbestos pad over the element reduces the upward dissipation of heat.

The thermostat, which is assembled to the clamp plate, consists of two spring contacts—the upper is flat with a silver contact riveted to the top of one end, the lower is hooked at one end, and its silver contact is riveted to the underside of the hook. The spring contacts are adjusted so that the upper one always bears against the cam and the lower one has sufficient pressure to ensure good contact. The thermostatic control is obtained as follows:—

As the iron heats up the bi-metal strip bends upwards owing to the higher co-efficient of expansion of the lower layer of metal. It rises until it presses against the porcelain pip in the lower contact spring. This raises the spring so that the supply to the element is broken. The cam controls the cut-off temperature by raising or lowering the upper contact spring, thus increasing or decreasing the distance between the bi-metal strip and the porcelain pip.

SERVICING AND MAINTENANCE

Preliminary Tests

(1) Inspect iron for mechanical damage and check connections at both ends of lead.

(2) Check lead for continuity with Avometer. Test insulation between mains leads and earth wire. This should not be less than 2.0 megohms measured on a 500-volt Megger. The E.M.I. Service Insulation Tester (Stock No. Q/D221) is ideal for this purpose—write for particulars.

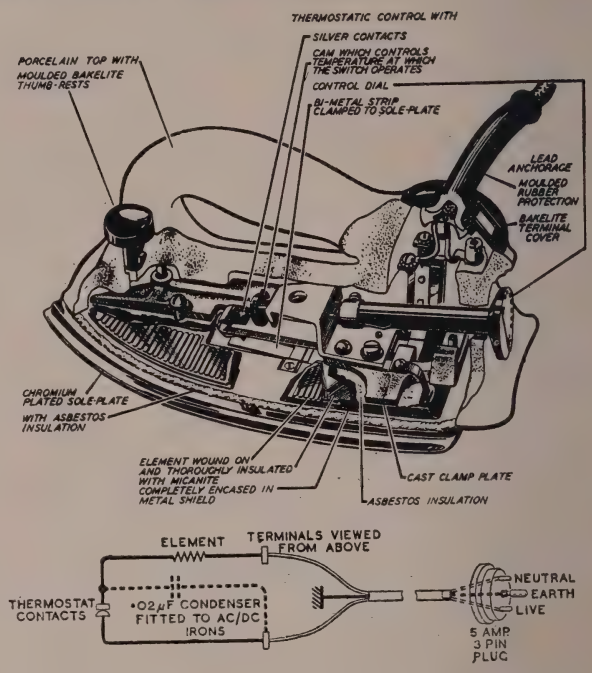
(3) Check resistance of element by measuring with an Avometer across the two lead connecting terminals.

Voltage	Approx. resistance —ohms
110-120	16
220-210	53
220-240	66
250	3.4

If an open circuit is indicated, element or switch is faulty, proceed to "Setting Thermostat" or "Replacing Element." If a short is obtained, proceed to dismantling (see "Setting Thermostat") and visual examination. If a much lower value is obtained, element is faulty, proceed to "Replacing Element."

(4) Check the temperature setting by connecting to **correct** voltage supply, turning knob to "HIGH" (H) and placing iron centrally on temperature measuring plate. The thermostat should cut out at a temperature of not more than 250° C. If an ammeter is connected in circuit the current readings when the element is on should be as follows:—

Voltage	Approx. current —amps.
110-120	7.2
200-210	3.9
220-240	3.5
250	3.4



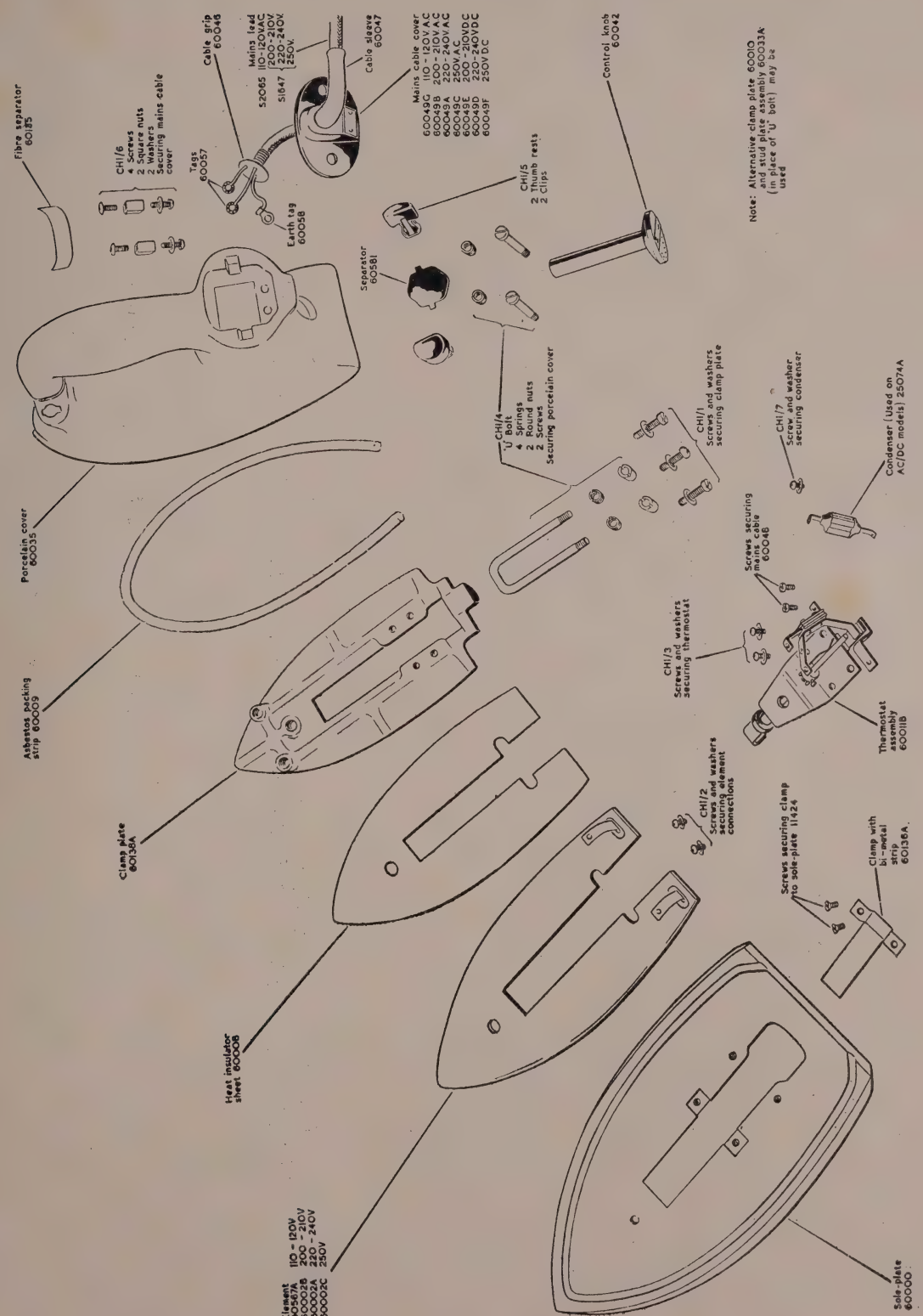
If incorrect operation is obtained proceed to "Setting Thermostat."

It must be emphasised at this point that although temperatures for setting-up operations and general testing may be measured by means of temporary fixtures such as a thermometer inserted in a drilled brass block which is placed in close contact with the sole plate, a device of this nature should not be regarded as permanent service equipment. Such an arrangement is slow in action and generally inconsistent in measurement due to the precarious nature of the contacts between the sole plate, brass block and thermometer. For expeditious and really accurate servicing, the E.M.I. Service Iron Tester, Stock No. Q/D251 should always be used. It can be used to set up all types of H.M.V. Irons and most others, and, as a piece of modern service equipment, it is as essential to the domestic appliance dealer as the analyser is to the radio engineer.

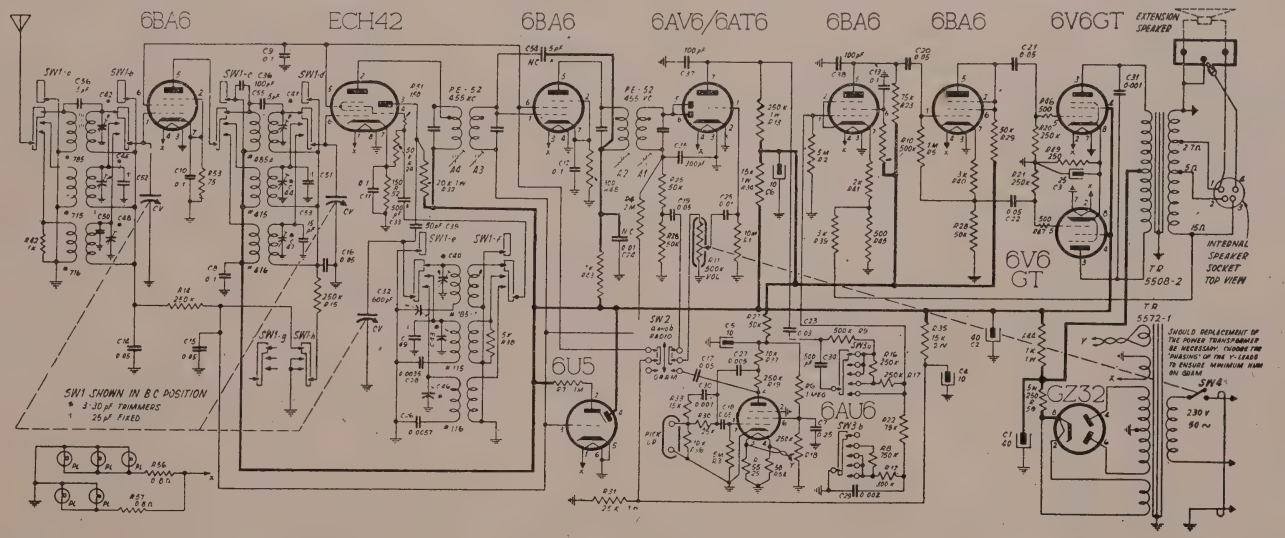
(To be concluded)

"R. & E." TECHNICAL PHOTOGRAPHS

Copies of original designs produced in our laboratory and featured in these pages are available. Prices are: Size 6 in. x 4 in, 3s. 6d.; 8 x 6, 4s. 6d.; 10 x 8, 5s. 6d. Please remit cash with order to Radio and Electronics (N.Z.) Ltd., P.O. Box 8022, Wellington.


Fibre separator 60185
CH1/6 4 Screws 2 Square nuts 2 Washers Securing mains cable cover
Cable grip 60048
Tags 60057
Earth tag 60058
Mains lead 52065 (110-120V AC) 51647 (200-210V) (220-240V) 250V
Cable sleeve 60047
Mains cable cover 60049C 110 - 120V AC 60049B 200 - 210V AC 60049A 220 - 240V AC 60049C 250V AC 60049E 200 - 210VDC 60049D 220 - 240VDC 60049F 250V DC
CH1/5 2 Thumb rests 2 Clips
Control knob 60042
Note: Alternative clamp plate 60010 and stud plate assembly 60033A may be used in place of 'U' bolt
Separator 60058
Porcelain cover 60035
CH1/4 'U' Bolt 4 Springs 2 Round nuts 2 Screws Securing porcelain cover
CH1/1 Screws and washers securing clamp plate
CH1/7 Screw and washer securing condenser
Condenser (used on AC/DC models) 25074A
Screws securing mains cable 60048
Asbestos packing strip 60009
CH1/3 Screw and washers securing thermostat
Thermostat assembly 60018
Clamp plate 60136A
CH1/2 Screws and washers securing element connections
Screws securing clamp to sole-plate 11424
Clamp with bi-metal strip 60136A
Heat insulator sheet 60008
Element 60567A 110 - 120V 60002B 200 - 210V 60002A 220 - 240V 60002C 250V
Sole-plate 60000

THE PACEMAKER MODEL 11352



SCHEMATIC DIAGRAM MODEL 11352.

VOLTAGE READINGS

Use	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8
R.F.	6BA6	0	0.6	—	6.3 AC	225	85	0.6	—
Conv.	ECH42	6.3 AC	225	67	—8	85	0	1.5	—
I.F.	6BA6	0	2.4	6.3 AC	—	220	85	2.4	—
Det.A.F.	6AV6	0	—	—	6.3 AC	0	0	75	—
Eq'izer.	6BA6	0	1.8	—	6.3 AC	125	27	1.8	—
Inv.	6BA6	15	107	—	6.3 AC	107	107	67	—
Output	6V6GT	—	6.3 AC	270	230	0	—	—	14
Output	6V6GT	—	6.3 AC	270	230	0	—	—	14
Rect.	GZ32	—	275	—	250 AC	—	250 AC	—	275
Eye	6U5	6.3 AC	20	0	225	—	—	—	—
Pre-amp	6AU6	0	—	2 AC	4 AC	112	17.5	—	—

RESISTANCE READINGS

Use	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8
R.F.	6BA6	2.4 meg	75	—	—	500 K	515 K	75	—
Conv.	ECH42	—	500 K	520 K	50 K	515 K	2.4 meg	150	—
I.F.	6BA6	2.1 meg	300	—	—	500 K	515 K	300	—
Det.A.F.	6AV6	10 meg	—	—	—	100 K	100 K	750 K	—
Eq'izer.	6BA6	5 meg	2.5 K	—	—	575 K	1 meg	2.5 K	—
Inv.	6BA6	1 meg	550 K	—	—	550 K	550 K	53 K	—
Output	6V6GT	—	—	—	500 K	250 K	—	—	250
Output	6V6GT	—	—	—	500 K	250 K	—	—	250
Rect.	GZ32	—	500 K	—	70	—	70	—	—
Eye	6U5	—	500 K	2.1 meg	1.5 meg	—	—	—	—
Pre-amp	6AU6	5 meg	—	20	20	800 K	250 K	—	—

1. D.C. voltage measurements are at 2,000 ohms per volt—A.C. voltage measurements at 1,000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative. Bandswitch in B.C. position.
4. Nominal tolerance on component values make possible a variation of ± 10% in voltage and resistance readings.
5. Volume control at maximum, no signal applied for voltage measurements.
6. Resistance readings in B+ circuits may vary widely according to the condition of filter capacitors.

N.Z. Radio Traders' Conference

(Continued from page 40)

selling costs, and indicated that servicing could reduce present profits quite considerably.

It was emphasised that, before prices could be stabilized in an upward direction, existing price cutting such as the giving of discounts to certain groups, minimum trade-ins irrespective of true value, and the supplying of records with a radiogram purchase, etc., would have to be stopped.

It was agreed that the matter should be pressed vigorously, and the Federation Executive was instructed to submit to the next annual meeting of the Radio and Television Manufacturers' Federation a request that the margins on all radios be not less than 50 per cent., with a minimum of £5 on lower priced sets.

High Fidelity Radios:

Concern was expressed regarding the sales of radios defined as "high fidelity sets", when, in fact, these did not strictly comply with the term. Various members expressed doubts about the practicability of defining "high fidelity" until some standards are fixed. Until this is done it would be impossible to approach manufacturers. Meanwhile it was left to reputable dealers to describe their sets correctly.

Public Service Investment Society:

A circular was submitted from the above society offering several different makes of radios at a discount of 15 per cent. off retail list price. Representatives of two manufacturers whose sets were named assured the Conference that their firms were not supplying the sets, but undertook to investigate the source if serial numbers were supplied.

Sales Tax:

Now that Sales Tax has been removed from musical instruments and furniture, Conference resolved that before the presentation of the next Budget, a further approach should be made to the Government, requesting the removal of Sales Tax from radio sets.

Goods and Chattels Act:

The attention of the Conference was drawn to the fact that a number of items being sold on hire purchase by radio and electrical dealers are not listed in the "Goods and Chattels" Act. Such unlisted goods could not be repossessed in the case of bankruptcy. Therefore, it was recommended that the Federation should supply dealers with a list of the items appearing in the "Goods and Chattels" Act, so that the latter could check whether the products they were selling under hire purchase were covered by this Act.

Election of Officers:

The election of officers resulted as follows:—

President: A. K. Griffiths (Nelson).
Vice-President: N. J. Hallett (Wellington).
Executive: B. C. Barwick (Wanganui), North Island Associations; R. M. Naysmith (Canterbury), South Island Associations.
Secretary: C. W. Archibald.
Auditor: Gordon Berry.
Representative on the Radio Interference Committee: D. B. Billing (Wellington).

SPECIALISTS IN A
SPECIALIZED FIELD.
MR. SERVICEMAN.
Our Universal Coils, types 40 (Aer), 45 (R.F.) and 41 (Osc) will replace any damaged R.F. Coil.
Inductance Specialists
THE N.Z. HIGH FREQUENCY SPECIALISTS
182 THORNDON QUAY, WELLINGTON, N.Z.
COILS, I.F. TRANSFORMERS H.F. CHOKES, B.F.O.'s DIALS, SCALES, COIL ASSEMBLIES, GANGS, BUILT-UP UNITS, ETC.

ELECTRONIC

ORGANS

INTERESTED?

"ELECTRONIC ORGANS,"
by R. L. Eby

8 chapters; 140 illustrations; 213 pages
(an American publication)

This is described as "a catalogue, text-book, and manual" on the following current American instruments: Allen, Baldwin, Connsonata, Hammond, Minshall, and Wurlitzer, as well as brief notes on other types.

Price, £3 8s. (Australian) (Approx. £NZ2 15s.)

"THE ELECTRONIC MUSICAL INSTRUMENT MANUAL,"
by Alan Douglas

7 chapters; 180 illustrations; 221 pages
(a British publication)

A complete primer on the subject, giving a sound grounding for both professional radio engineer and the amateur enthusiast and constructor. Comprehensive, clearly written, and profusely illustrated, it is a "must" for anyone interested in electronic musical instruments.

Price, £2 5s. (Australian) (Approx. £NZ1 16s.)

The above books are obtainable from:
PUBLICATIONS DIVISION, THE ELECTRONIC ORGAN COMPANY (AUSTRALIA)
9-11 Cadow Street, Pymble, N.S.W., Australia.

Please do NOT send cash! Payment should be made by bank draft or a postal order on Gordon, N.S.W. (suburb of Sydney), for the Australian currency amount above.

HERE'S NEWS . . . ! ! !
Published in March this year, and shortly to be made available in New Zealand through this Company only:
"SIMPLE ELECTRONIC MUSICAL INSTRUMENTS FOR THE CONSTRUCTOR," by Alan Douglas
Please watch our future advertisements, in this magazine, for further details.

We invite you to let us have your name and address for our mailing list, without obligation, in order that we may keep you up to date on our latest products and publications, which cover radio, TV and electronics generally. A brochure will be sent upon request.

THE ELECTRONIC ORGAN COMPANY (AUSTRALIA)
9-11 CADOW STREET, PYMBLE, N.S.W., AUSTRALIA

Impedance Comparator

(Continued from page 23.)

THE FULL CIRCUIT

We are now in a position to examine the full circuit diagram with an understanding of its functions. The V.T. voltmeter circuit consists of a 6SN7 valve, in a circuit which corresponds almost exactly with that of Fig. 2. The only essential difference is that, instead of the lower end of the cathode resistor being earthed, the power supply is earthed only through a voltage divider. The latter consists of a 33k. resistor to earth from the positive terminal of the supply, and approximately 25k. to earth from the negative side. The purpose of this connection is nothing more than to place the grids of the 6SN7 so near earth potential that connecting them to earthed diode circuits will not upset the operation of the voltmeter circuit. This is much easier than floating the whole of the diode circuits above earth, as would have to be done otherwise.

It will be noticed that an apparently complex circuit containing four diodes is connected to the grids of the 6SN7. These diodes are not fundamental to the action of the circuit, acting merely as protection against over-loading of the meter movement, and their action will be described later.

Going backwards through the circuit we come to the two rectifier diodes which are fed from cathode followers. The latter are included so as to provide a low-impedance source for the diode rectifiers. Were this not done, there could be a quite serious effect on their rectification efficiency, and this would cause the instrument's sensitivity to be rather less than one would expect. The cathode followers are preceded by single stage amplifiers, arranged to have a gain of ten times. In order that this gain may be stable, and as little as possible subject to variations caused by valves ageing, the figure of ten times is obtained in practice by using high-mu triodes as the amplifiers. These, with a load resistance of 100k., as shown, would normally have a gain of some 56 times, but it will be seen that there is a cathode load resistor of 10k. as well as the plate load resistor in each valve circuit. This unbypassed cathode resistance is chosen so as to provide the right amount of negative feedback to give a gain of approximately ten times. The advantage of this arrangement is a considerable increase in stability, for it results in a change in amplification factor of, say, ten per cent., causing less than 2 per cent. change in stage gain.

With an amplifier gain of ten times, it can be seen that the diodes have a signal of the order of ten volts R.M.S. to work on instead of only one volt, as would occur if the amplifiers were omitted. This is quite important, because the efficiency of thermionic diodes is very much lower than usual when the signal input is as small as this. With ten volts or so to work on, however, the rectification efficiency can be of the order of 90 per cent., as against 60 per cent. or so for small signals. A further advantage of the use of amplification is that, instead of measuring an effective signal of 0.1v. for an indication of 10 per cent. deviation from the value of the standard resistor, the voltmeter has 1 volt to measure for the same effect. This increase of sensitivity enables a 0-1 ma. meter to be used for many applications, while where still more sensitivity is needed it is possible to obtain it simply by using a more sensitive meter movement.

(To be continued.)

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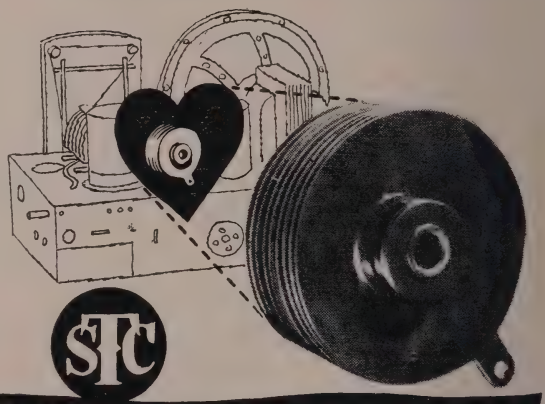

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Record Talk

(Continued from page 34.)

EMI'S version of "Melody of Love" comes on Columbia DNZ 5057, with the Four Aces adding their "new" number, "There is a Tavern in the Town". Kitty Kallen is featured in the novelty "Don't Let the Kiddy Geddin" (an instruction to keep the cat out of the house) on DNZ 5010, and Red Foley is up to the minute with "Hearts of Stone" (DNZ 5051). Then there are Frank Chackfield's "Blue Mirage" (Y 6697), "Open Your Heart", not to be confused with "Open Up Your Heart"! and sung by David Whitfield on Y 6683, and Marilyn Monroe in two numbers from the recent "Show Business" film on HR 10072. Homer and Jethro have a story to tell about someone they call "The Nutty Lady of Shady Lane" on HR 10077. There is a "Holiday Sing Song", led by George Elrick and recorded at one of the Butlin Holiday Camps on F 10318, and Mantovani is in his usual form with "Our Dream Waltz" and "Ma Chere Amie" on F 10455.

Perhaps the most famous set of records made locally was the series featuring the Rotorua Maori Choir, done by Columbia around about 1929. They have remained steady sellers, and there has been nothing in subsequent releases that has quite replaced them. H.M.V. are therefore wise to give these records a fresh currency, by issuing new pressings under the original Columbia numbers. There are ten discs, and memories will be quickened by such titles as "E Pari Ra" (DO 51), "Pokarekare" (DO 54) and "Hoki Hoki" (DO 58). "Home Little Maori Home" is on DO 67.

EMI'S LP release is once again big and comprehensive enough to warrant a page to itself. Where to begin? A boxed set, entitled "Homage to Diaghileff", pinpoints the current—largely American—tendency towards the production of "packaged" LPs, three or even more discs got up in an album and assembled around some theme, musical or otherwise. The present set (Columbia 33CX 1197-9) gives a bird's eye survey of the music for some of the ballets produced by Diaghileff's company throughout the twenty years of its existence from 1909 to 1929. The result is a rather maddening jumble, and I fail to see the point of including one tiny mazurka from "Les Sylphides" and an equally short dance from "The Three Cornered Hat". Connoisseurs will be attracted to such rare scores as Satie's "Parade" and Prokofieff's "Les Pas d'Acier", but the former is inextricably coupled with "Invitation to the Dance" and "Afternon of a Faun". Surely a more convenient arrangement could have been devised; but the playing by the Philharmonia, under Diaghileff's last musical protege, Igor Markevitch, is fully worthy of the occasion, and the selection from "Swan Lake" manages to include at least one piece which is not to be found in the "complete" Decca recording of that ballet.

Another record (33CX 1204) contains a jumble of Puccini operatic arias, made thoroughly desirable by the fact that the singer is none other than the fabulous Maria Meneghini Callas, whose voice and style have until now been accessible only to those prepared to invest in complete operas. Callas, who can sing anything from Norma to Isolde and back again to Rossini's Armida, here proves herself in Puccini roles from Mimi to Turandot. Practically every one of the master's heroines is represented on this record, in which the singer is given wonderful support by the Philharmonia Orchestra under the veteran Tullio Serafin. In listening to Turandot's outpourings we have to go right back to Eva Turner for a just comparison, and with what a wealth of expression does Callas give voice to Madame Butterfly's woes and tribulations! Perhaps the items on this disc will eventually reappear in 45 or even 78 form, but for the complete devotee, both of Puccini and of Italian opera singing in general, the whole disc will be an essential purchase.

A final word to opera lovers: the classic Glyndebourne set of Mozart's "Don Giovanni", which some of us eagerly bought when it was available on no fewer than 23 cumbersome shellac discs in the distant era of the "gramophone", has now been transferred, expertly and satisfactorily, to exactly three LPs (H.M.V. ALP 1199-1201). None of the later achievements of LP quite equals this in interest and potentiality: for what has been done in one instance can doubtless be done in others. We must hope that more treasures from the gramophone's glorious past will be as happily and as conveniently revived.

A Novel A.V.C. System

(Continued from page 25.)

and chassis. If two or more valves are to be controlled, each can be provided with its own bias resistor, and the lower ends of these can be joined. Then, only one resistor need be used in order to keep the cathodes above ground, instead of a separate one for each valve. In Fig. 3 we have drawn a practical circuit showing one EF50 as controlled stage, with an EF37 as a D.C. amplifier. If only two stages are to be controlled, then the resistor between the cathodes and ground should be halved in value, and this will not necessitate any other circuit changes.

The original inventors of the arrangement suggest that the D.C. amplifier valve could also be used as the A.F. voltage amplifier, and in applications where a small amount of distortion can be tolerated, this would be quite satisfactory, and would effect a saving of one valve. Figure 4 shows how this can be done; the blocking condenser at the lower end of the volume control potentiometer ensures that the full D.C. output of the diode is always applied to the amplifier, irrespective of the volume control setting. Incidentally, the variation of bias on the amplifier valve will not be very great, because the A.V.C. system will ensure that the detector output is never greater than about half a volt D.C. Thus, provided that the audio chain has sufficient gain to limit the grid signal of the amplifier to a quarter of a volt, or thereabouts, little distortion can arise through variations in the D.C. bias of the amplifier.

Altogether, this arrangement has most interesting possibilities and should find application by many experimentally minded builders of receiving equipment.

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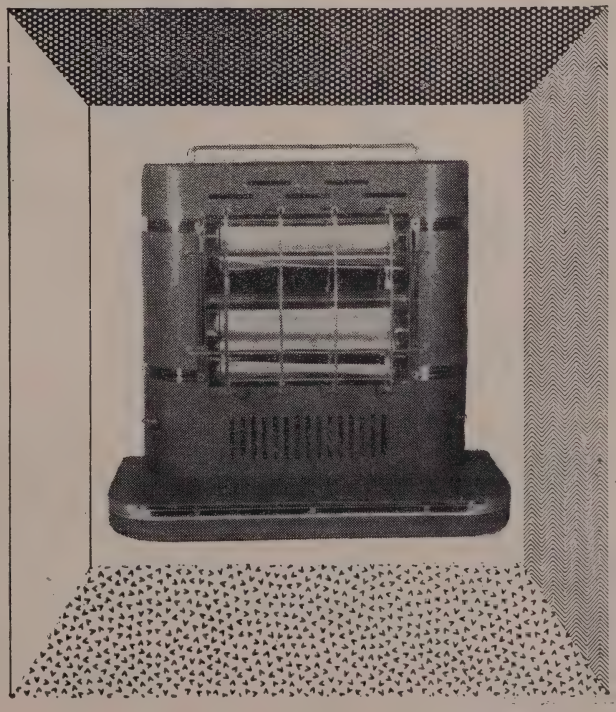

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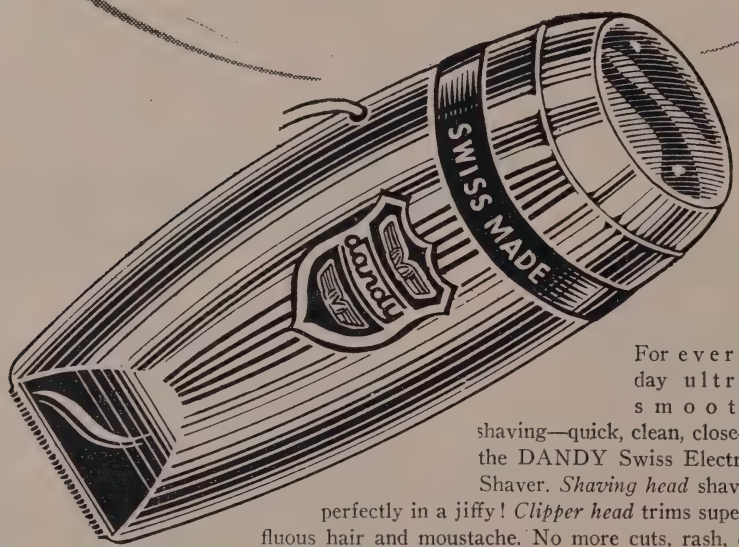

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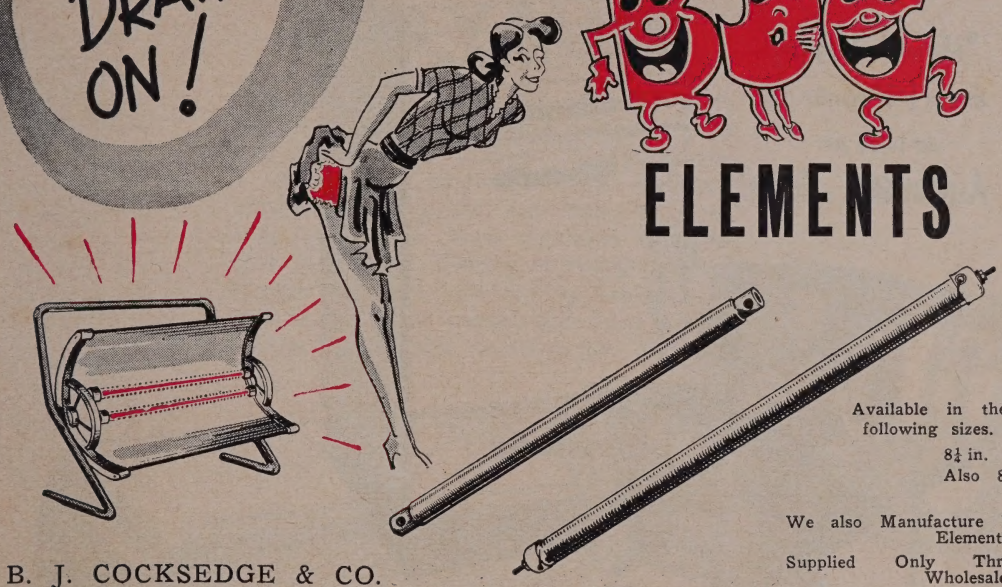

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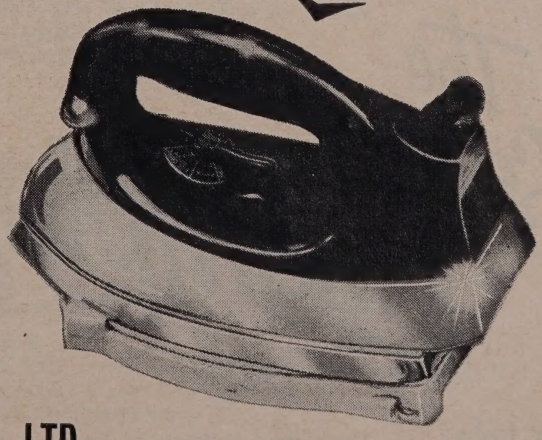

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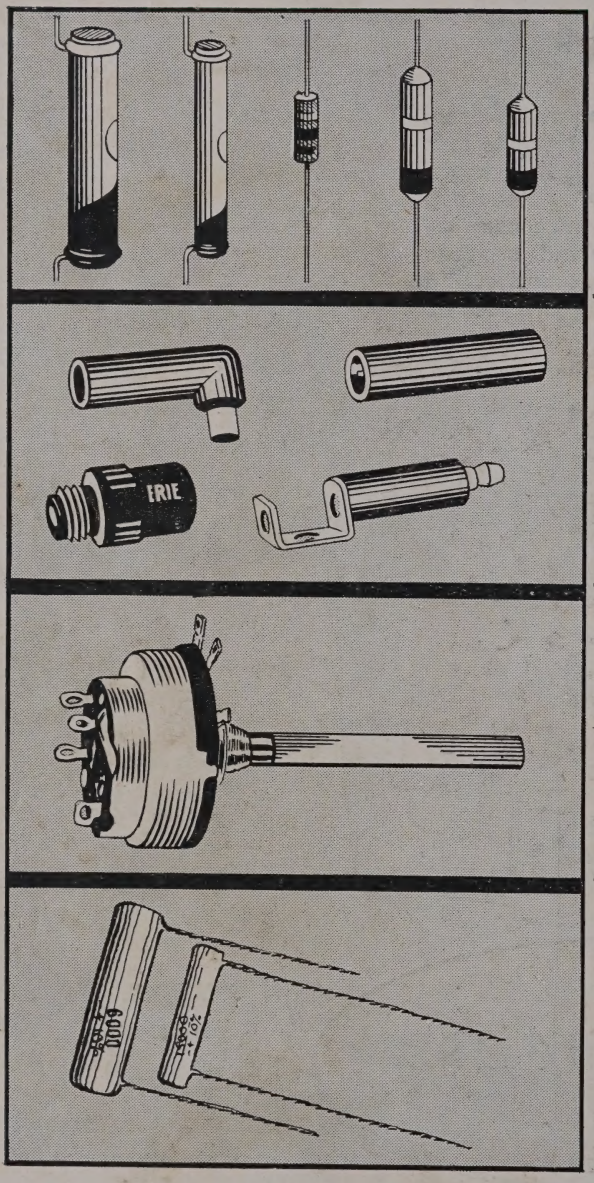

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